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ABSTRACT

Effective technology transfer requires addressing several complexities that arise repeatedly in the vast majority of technology transfer projects. One of the objectives of this study was to define common issues/pitfalls/concerns among the various entities in the technology community and to allow them to express their views and opinions on how best to address specific issues. This final report is organized as follows: The first section consists of a reprint of the paper, "Benchmarking Best Practices in Technology Transfer," (Brian Gurney and Lawrence K. Anderson) which was presented at the 1993 annual meeting of the Technology Transfer Society, and which can serve as an executive summary for this report. The second section consists of a reprint of the survey instrument through which experts were asked to rate and comment on candidate best practices. The third section is a set of charts and commentary for a selected set of the candidate best practices--in general those that turned out to be the most controversial or for which the results were unexpected. Survey responses are divided into universities, federal laboratories, intermediaries, small companies, and large companies. The final section consists of a short set of brief final conclusions, based primarily on the survey results. It was discovered that in the following areas there was a considerable difference between what common wisdom prescribes and what is being done by actual practitioners: keeping it simple, technical audits, the role of intermediaries, and support for technology transfer. (MAS)

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ED 385 214

BENCHMARKING BEST PRACTICES IN TECHNOLOGY TRANSFER

FINAL REPORT
DECEMBER, 1993

Principal Investigator: Dr. Lawrence K. Anderson, Director, CITTI
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TABLE OF CONTENTS

I. FORWARD

II. PREPRINT: "Benchmarking Best Practices in Technology Transfer"
by Brian Gurney and Lawrence Anderson

III. BEST PRACTICES SURVEY INSTRUMENT, WITH RAW DATA

IV. SELECTED RESPONSES, WITH CHARTS AND COMMENTS

V. FINAL CONCLUSIONS

I. FORWARD

Not too long ago, an article was published in a popular automobile periodical, describing how an American automobile manufacturer "broke the barrier" of 5 years from the inception of design to the actual production of the first model of an automobile. Three important points to keep in mind in this case are the time period involved, the fact that the bulk of the product/manufacturing development work was carried out under one corporate roof, and that this major U.S. manufacturer had developed many new models of automobiles over its corporate history. And when this automobile was introduced into the marketplace, it really did not contain anything that was considered a "new technology."

With this example in mind, we should not be surprised at how difficult it is to transfer a "new" technology between two parties that do not know anything about each other, are headquartered in opposite ends of the country, have very limited R&D budgets, have no or relatively little experience with technology transfer processes, are transferring a technology for which the market assessment is, at this point, "it's anybody's guess" and finally for which the CEO would like to see a working prototype in six months!

Effective technology transfer requires us to address several complexities that arise repeatedly in the vast majority of technology transfer projects. One objective of our study has been to define common issues/pitfalls/concerns among the various entities in the technology community and to allow them to express their views and opinions on how best to address specific issues.

This final report is organized as follows: The first section consists of a reprint of the paper, "Benchmarking Best Practices in Technology Transfer", which was presented at the 1993 annual meeting of the Technology Transfer Society, and which can serve as an executive summary for this report. The second section consists of a reprint of the survey instrument through which we asked experts to rate and comment on candidate best practices, with the raw response data superimposed. The third section is a set of charts and commentary for a selected set of the candidate best practices - in general those that turned out to be the most controversial or for which the results were unexpected. The final section consists of a short set of brief final conclusions, based primarily on the survey results.

II. PREPRINT

BENCHMARKING BEST PRACTICES IN TECHNOLOGY TRANSFER

BENCHMARKING BEST PRACTICES IN TECHNOLOGY TRANSFER

by

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and
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Introduction

Technology Transfer is a complex process. In some ways it can be an overwhelmingly complex process. At one extreme it subsumes the entire innovation process, from the germ of an idea to a new and successful product or service in the marketplace. At the other extreme it may consist only of the legal process whereby ownership of a particular piece of intellectual property - a patent, for example - passes from one person to another. For the purposes of this paper, we will take the broader view as exemplified by the process flow shown in Figure 1, which applies most directly to the commercialization of university-developed technology. This representation emphasizes the communication/feedback processes in technology transfer. Any meaningful study of best practices in technology transfer must recognize the complexity and uncertainty of such a process, with its multiple parallel paths and nested feedback loops, all contributing to a process which in effect is more nearly random than deterministic.

Benchmarking is a similarly complex and somewhat arbitrary process. In one definition it is "... a process for continuously measuring a company's business operations and comparing them to best-in-class operations" (1). In another definition it is "... the search for those best practices that will lead to the superior performance of a company" (2). The first definition focuses on measurement and comparison. The second focuses more on search and identification. For the purposes of this study, we have used a definition closer to the latter, our definition being, "The search for those best practices which, in a given context, will lead to the most effective transfer of technology". Within the context of this definition, our approach to benchmarking has been in consonance with general practice. As applied specifically to technology transfer, our approach has been to: 1. Analyze the process whereby a given transfer product or service is provided into its elemental steps, or operations; 2. Search for organizations who perform a particular step in that process best; 3. Discover and document how they do it; and 4. Synthesize these individual best practices into a superior process for successfully transferring the product or service.

As applied to benchmarking in industry or business , "best" is determined ideally by quantitative measures (e.g. highest process yield, fewest customer complaints, etc.).

But in practice, the "best practitioners" are more likely to be selected by reputation. In our study, we have been forced by the uncertainties in the technology transfer process to use an almost Delphic approach, identifying our best practitioners by reputation and referral and then identifying our best practices by expert consensus, as will become evident when we discuss our methodology.

As stated earlier, our pragmatic definition of "best practices" is: Those activities which will lead to the most effective transfer of technology. This leads to the question, of course, of how to measure effectiveness. Ideally, we would like to identify quantitative metrics. This turns out to be extraordinarily difficult. Different sectors, e.g. public vs. private, have different approaches to metrics. There is, to be sure, general agreement on ultimate measures of success for a new product or service in the marketplace - typically increased profits to a company, more jobs in a community, etc. But to gauge the effectiveness of the technology transfer effort we need to know what input was responsible for that output. Effectiveness means maximum output for minimum input. This is where the root of the difficulty lies. The progress of a given technology transfer activity is so confounded by extraneous events that it is generally impossible to relate any particular output uniquely to the presence or absence of any particular input. Said another way, while we can measure the output of the technology transfer process, and think that we can identify the inputs (but probably cannot do so completely), we have very few in-process metrics that link specific inputs and outputs by cause and effect. This is an active area of research that we and others are pursuing diligently (3).

The central problem in technology transfer is that it is an incredibly people-intensive process. We are told (over and over again!) that it is a "contact sport." Can one systematize the process so that it can be carried out by rote? The consensus is a very strong "No!" If this is indeed true, then the prospects for improving the productivity of those involved in the process are not good. No one yet has been successful at developing a "unified" theory of technology transfer. The number of "elementary particles", i.e., options for action, is still increasing. There is no magic formula, no silver bullet. Thus, we are reduced to the Delphic approach. We assume that we will recognize successful technology transfer when we see it; that experts will recognize and can communicate what works in particular situations. What we are left with, in defining our best practices, is then a set of "hints and kinks", a sort of "Popular Mechanics" approach to technology transfer, rather than a "Physical Review" approach. In spite of these limitations, however, this study has produced insight into the technology transfer process that can be applied to real world situations by those of us charged with making it happen.

Goals and Methodology

The primary goal of our study has been to compile a listing of best practices that can be applied selectively within a given technology transfer context. Emphasis has been on those practices that can help technology transfer intermediaries, such as CITTI, do a more effective job in brokering technology between buyers and sellers. A secondary goal has been to build lasting relationships between CITTI and other practitioners in the field. For the reasons outlined above, we have been only partly successful in the first of these goals, so that rather than focusing exclusively on conclusions, we have included enough details of our approach and findings that the reader can use our results to set strategy within the context of his/her own situation.

We began our study with an extensive electronic search of both the local and world-wide technology transfer and technology management literature, looking for matches between technology transfer, benchmarking, best practices and related key words. We also networked extensively with our professional colleagues. In this way we were able to identify some half dozen publications of various sorts which dealt directly with the topics of interest and some 60 additional publications that dealt individually with some aspect of the topics. We scanned this literature, noting those technology transfer actions or practices that the author(s) could show, convincingly, were particularly effective. In this way, we generated some 300 possible "best practices", in the form of vignettes applicable in various contexts. Our challenge, then, was to arrange these on some sort of framework, editing, combining, eliminating and augmenting them so that they made pedagogical sense and could be applied in real-life situations.

Our approach to a framework was to adopt a business analog. Our research to this point had led us to conclude that technology transfer, as an entrepreneurial activity, was subject to the same general, time-tested rules as any other business activity. Using current "buzzwords", we might be tempted to call this the "Total Quality Management" approach. But one of our findings is that the technology transfer community is very distrustful of this terminology, with its connotation of "ten ways to instant success", so that we prefer to refer to "common sense business practices". With this model in mind, we adopted a framework consisting of six "core" best practices. Our premise, in advancing these core practices, is that successful technology transfer requires that the practitioner:

1. Know the technological capabilities of the supplier (or seller) of the technology. What does the supplier have to sell?

2. Know the nature of the marketplace and the technology needs of the customer (or buyer) of the technology. What does the customer need?

3. Provide appropriate resources (both buyer and seller) to the technology transfer process.

4. Reward behavior that will drive current and future technology transfer success.

5. Formulate an organizational strategy in which technology transfer is recognized as a central mission.

6. Communicate this strategy, in the form of specific guidelines, policies and procedures, etc., to all levels in the organization, and to the customer as well.

We then associated each one of our candidate best practices with one of these six core practices, combining and eliminating them as appropriate. Our next step was to get systematic feedback from experts in the field - individuals and organizations who had a reputation for having been involved in successful (and sometimes not so successful!) transfers of technology. To do this, we designed a survey in which the candidate best practices, a total of 144, were grouped in the six core areas above, each formatted as a direct statement with which the respondent was invited to agree or disagree, in varying degrees, and to comment. Excerpts from the survey, along with the associated responses, are included as Appendix 2. (The entire survey was 27 pages long, and, with the respondents' comments, much too extensive to include here.) In some cases, the candidate practices were in conflict, depending on the context. This was deliberate, designed to produce a range of responses.

During our literature search and subsequent networking, we had identified some 60 "best practitioners". These were selected so as to represent five different types of organizations:

1. Technology transfer intermediaries, both private and public sector
2. University patent licensing organizations (as suppliers of technology)
3. Federal laboratories (also as suppliers of technology through each laboratory's Office of Technology Application, or equivalent)
4. Large companies (as buyers of technology)
5. Small companies (also as buyers of technology)

Copies of the survey were mailed to each of the identified organizations and individuals. Statistical information on the respondents is included as Appendix 1. Over three-quarters of the surveys were returned with useful inputs, an unusually high response rate, especially given the length of the survey. We take this as a measure of the intense interest in a study of this sort.

For analysis, all of the responses, including the comments, were entered into an electronic database (4).

PRELIMINARY RESULTS

It is important to note that although the statistical data presented below are accurate, there has been time for only limited face-to-face follow-up with individual respondents. Accordingly, the results below must be viewed as preliminary. A more definitive and in-depth analysis and set of conclusions will be forthcoming.

As mentioned earlier, our research generated six (6) critical "core" practices which we presented in our survey. We asked each respondent to evaluate each core practice as to whether he/she generally agreed or generally disagreed with the statement.

Listed below, individually, are excerpts from each core practice along with a numerical breakout of how the respondents reacted. Then, for each core practice, we have attempted to summarize the essence of the respondents views on a few of the associated candidate best practices, where there were clear trends or obvious controversy.

I. Strategy/Policy (50 candidate best practices)

"...Every R&D institution must formulate a strategic plan for technology transfer and integrate it into the overall strategy/business plan of the institution. This strategic plan must be "owned" by all levels of the organization....The technology transfer strategic/business plan must identify as clearly as possible its products (the range of technologies to be transferred) and its customers (the market segments to be addressed)."

Preliminary Result: All 45 (100%) of the respondents generally agreed that this core practice was necessary, to some degree, for a successful technology transfer project and organization.

Preliminary Findings: There was broadest, positive consensus in two areas:

1. Partnerships: Both parties (sender and receiver of technology) must cultivate a strong sense of partnership, including open communications and a high level of trust.

2. "Clear Title": There must be full disclosure by the technology transfer source of any impediments, legal or otherwise, to licensing a given technology.

II. Communication/Organization (21 candidate best practices)

"Effective technology transfer requires the use of the standard project management and communication best practices,... the use of cross-functional teams and formalized project tracking (e.g. GANTT, PERT charts) with the responsibilities of all parties clearly defined in legally supportable written documentation."

Preliminary Result: Forty out of 45 (89%) of the respondents generally agreed that the communication/organization core practice was necessary, to some degree, for a successful technology transfer project and organization.

Preliminary Findings: The strongest consensus concerned the need to deal with the "culture gap" between the for-profit private sector companies and the not-for-profit public sector sources of technology. In particular public sector sources and sellers of technology have to understand the private sector mindset of "I need a technology that is manufacturable in the appropriate quantities, a market that can be successfully exploited and a healthy profit margin."

The area of strongest disagreement concerned the emphasis on and value of Cooperative Research and Development Agreements (CRADAs). In particular, many respondents, particularly those in the private sector, felt that there were significant limitations to the CRADA process. It was criticized as being slow, bureaucratic, lacking consistent interpretation, etc. In order for the CRADA process to gain credibility (and be useful), it must be streamlined and made consistent at least at the agency level, especially to attract more small businesses.

III. Inventory (14 candidate best practices)

"...tech transfer entities should maintain an inventory of their facilities, capabilities and strengths and pursue strategies which capitalize on these strengths."

Preliminary Result: Forty-four out of 45 (97%) of the respondents generally agreed that "inventory" was a necessary core practice, to some degree, for a successful technology transfer project and organization.

Preliminary Findings: There was widespread agreement that private sector companies wishing to establish or protect a leading edge position must relentlessly look beyond their own walls for new technology -- including monitoring federal and university laboratories.

An area of significant controversy concerned the desirability of a periodic audit of a given laboratory's technology with a view to identifying "non-productive" activities as candidates for elimination. Concerns included the difficulty of establishing robust criteria for "productive" vs. "non-productive" research and the danger of alienating critical R&D staff if the process is done insensitively.

IV. Market Assessment (25 candidate best practices)

"...All institutions that buy or sell technology must have in place some mechanism for assessing a technology's market potential....Institutions should not assume that technologies will "sell themselves" without further refinement...."

Preliminary Result: Forty-two out of 45 (93% of the respondents generally agreed that "market assessment" was a necessary core practice, to some degree, for a successful technology transfer project and organization.

Preliminary Findings: While there was little disagreement with the importance of a proactive program for technology marketing, the overwhelming opinion of our respondents was that the crucial linkages between the public sector and the private sector to transfer potentially marketable technology are either nonexistent or very weak.

There was significant cynicism, especially among small business, with respect to the "trade fair" approach to marketing university and federal technology. For example, respondents felt that Federal Laboratory Consortium meetings were not the place for small businesses to be if they were searching for a specific technology or wanted to interface with a particular lab. Many of the respondents felt that such meetings "were a waste of time" and that private sector companies should go directly to a particular laboratory to seek technology/contacts.

V. Resources (17 candidate core practices)

"....technology transfer requires unavoidable up-front commitment of money, people and time. . . . .the question becomes, "How do we acquire, maintain, optimize, protect and generally best utilize these resources...."

Preliminary Result: Forty-three out of 45 (95%) of the respondents generally agreed that the core element that addresses "resources" was necessary, in some degree, for a successful technology transfer project and organization.

Preliminary Findings: The message from our respondents was "loud and clear"; fully 2/3 "strongly agreed" that for a technology transfer activity to be successful, having a "champion" on the sending end as well as one on the receiving end was essential.

There was significant controversy, however, concerning a practice that would require technical people to dedicate time explicitly to technology transfer activities. There was a strong undercurrent that researchers should, by and large, stick to their research (see VI below) and any policy of direct involvement must be very flexible. For example, some respondents suggested a sliding scale where during project initiation as much as 50% of a technical person's time may be appropriate, decreasing toward 0% as the project nears completion.

VI. Reward/Recognition (17 candidate best practices)

"...A tech transfer project or organization....must have a well thought-out reward system that drives the desired organizational behavior, builds a team approach, and fairly recognizes the contributions from all members of the team...."

Preliminary Result: Forty-four out of 45 (97%) of the respondents generally agreed that the core practice of "reward/recognition" was necessary, to some degree, for a successful technology transfer project and organization.

Preliminary Finding: While respondents were generally supportive of a structured system to reward researchers for successful technology transfer, there was obvious concern, for better or worse, that such activities could detract significantly from traditional missions. For example, many respondents, inside and outside academia, felt that the job of university faculty was to teach (and do basic research?), not to pour an inordinate amount of time into technology transfer activities. There was no broadbased support for a university policy that required its faculty members to spend a prescribed portion of their time on tech transfer activities.

Another area of concern was how to deal with the problem of faculty members bypassing the university's technology transfer office. The consensus was that faculty members should not be forced through the system with a "big stick". Instead, it was agreed that the most effective way to make sure the university tech transfer office is used effectively is by staffing it with knowledgeable, competent and courteous professionals that provide critical value-added services in a timely, cost-effective manner.

PRELIMINARY CONCLUSIONS

We have not yet been able to draw definitive conclusions from our study. In particular, we are not yet able to provide a concise listing of generally accepted, universally applicable, best practices in technology transfer. There are several reasons for this, some operational, some fundamental:

1. Since critical returns were still being received through the end of May, in-depth analyses and conclusions are still being derived and formulated.

2. Many of our respondents still have fundamental concerns with the technology transfer process, as discussed below, masking their ability, and ours, to identify specific best practices.

3. As discussed in the introduction and below, the extreme complexity of the real technology transfer process defies attempts to develop simple formulas.

For these reasons, the conclusions we present below should be viewed more as a commentary on the state-of-the-art than as definitive prescriptions for success.

THE CORE PRACTICES

There was almost universal agreement among all sectors of the technology transfer community that the six core practices described in the section on Methodology above present a useful template to guide technology transfer decision making. To generalize this still further, we may conclude that the technology transfer process is amenable to the application of general best business practices and general business planning, although not, perhaps, to the latest management fads. While this may seem trite and obvious, the comments and concerns of our respondents, particularly those who are recipients of technology (i.e. the customers of the process), make it very clear that much technology transfer is attempted without the commitment to customer, sense of urgency and attention to detailed excellence that a private sector business would apply today as a matter of course.

THE ROLE OF INTERMEDIARIES

From the viewpoint of small businesses, in particular, the most effective technology transfer intermediary is a broad-based "generalist". The small business is best served by a technology transfer intermediary capable of providing access to a wide range of services rather than one specializing in one area, for example, intellectual property/legal issues. Besides the roles of coach and liaison, the small business intermediary may be called upon for marketing expertise, to seek-out a capable manufacturer, to help identify sources of capital, etc. To serve large businesses, however, the technology transfer intermediary is more likely to be successful if it possesses in-depth knowledge and wide-spread contacts in the technical areas of specific interest to the customer.

It is clear from our survey that there are many concerns and some cynicism with respect to technology transfer intermediaries. As the field explodes, many external technology transfer service providers and internal technology transfer offices are attempting to deliver inappropriate services or lack the in-depth expertise or ready-access to expert advice to deliver services they agreed to provide at the level of excellence their customers expect. As a result:

1. The role of the "intermediary" itself is suspect in some quarters as to whether it should be utilized at all. This is especially the case among large private sector businesses.

2. Small and medium-sized businesses entering into a tech transfer agreement/project for the first time, are full of hope as well as bewilderment and apprehension. The customer has very high (perhaps unreasonable) expectations. If and when the intermediary fails to delivery to those expectations, the failure can discredit the entire technology transfer process including the federal and university laboratory participants. Clearly the intermediary must focus on excellent performance while educating the technology customer on the limitation of the process. Not all intermediaries have performed at this level.

A partial solution to some of these problems may be a formal licensing or certification procedure for technology transfer intermediaries, perhaps through the aegis of the Technology Transfer Society.

UNIVERSITIES AND RISK

Technology developed in a university setting is unlikely to market itself. Thus, it is appropriate for most research universities to establish and maintain proactive technology transfer offices. However, many of our respondents felt that only in rare cases was it appropriate for a university to broaden its mission to include such high risk activities as venture capital and research parks. Such ventures, it was felt, are best left to the for-profit private sector.

THE FEDERAL BUREAUCRACY: PERCEPTION AND REALITY

Federal laboratories are consistently criticized as being "stonewall" bureaucracies that can be penetrated successfully only by the largest, patient Fortune 100 companies. Many federal agencies and laboratories are mounting aggressive programs to share their resources in a user-friendly way in an effort to combat this perception. But our findings indicate that these efforts are undermined by lack of consistency among different laboratories, even those within the same agency (e.g., DOD, DOE, DOC, etc.), with respect to policies, procedures, ways to handle CRADAs, etc.

The federal government should establish a consistent set of operating practices for technology transfer that make it easy for private sector companies to partner with different laboratories.

COMMITMENT OF PUBLIC AND PRIVATE SECTOR

Federal laboratories do not feel that their mission is to fully commercialize a specific technology through to the market place. Instead, their view is that those private sector organizations that possess the expertise and resources for full commercialization must commit an increasing amount of resources toward the later stages of a technology commercialization project.

Therefore, private sector organizations wishing to enter into agreements with federal laboratories must be prepared to commit substantial resources toward a tech transfer project, going beyond the letter of the contract.

MEETING COMMITMENTS AND CHANGING PERCEPTIONS

Federal laboratories have some degree of concern about the depth of commitment that private sector organizations have and are willing to put forth in a tech transfer project. This concern is greatest with respect to the smallest companies. Therefore, there is a strong preference for the federal laboratory to deal exclusively with Fortune 500 companies.

Small businesses are in constant danger of over-extending themselves from both a financial and technical resource standpoint. They need a public and/or private sector "safety net" in place to help them complete the project.

INVENTORY AND DATA MANAGEMENT

Large public sector institutions need to actively inventory their resources, facilities, assets and technologies by some form of centralized electronic means. However, there is some apprehension that public sector institutions will fail to consistently allocate the resources necessary to maintain the electronic database.

The most appropriate method to build and maintain a consistent and comprehensive national-scale database, may well be to utilize the private sector. Competition and the profit motivate will provide the best service.

Public sector institutions must be willing to divulge the data necessary for a private sector-managed database to be effective. To justify the resources necessary to establish and maintain such national scale databases, however, there must be a win/win/win situation for the public sector institution, the database manager and the users.

STUDENT RESOURCES

Graduate level students at universities can be a valuable resource in some aspects of a tech transfer project. An ideal profile for this particular resource would be as follows:

1. Use engineering students that are completing an MBA
2. Apply close supervision to their activities
3. Be aware of the timing appropriate to academic institutions

16

MANAGEMENT OF TECHNOLOGY TRANSFER

The primary goal of any technology transfer project is to completely and successfully transfer a technology from one entity to another. Our respondents felt strongly that technology transfer is not the place to test leading edge management theory or practices. Instead, the best approach is to apply established, conservative management techniques. Over time, on later projects that have the benefit of learning curve effects, some of the strongest leading edge practices may be attempted and carefully evaluated as to their effect.

However, one leading-edge practice, which received strong endorsement, is the application of cross-functional teams. A carefully managed mix of technical and non-technical personnel working toward a common goal, i.e. transfer of technology, has proven to be an effective approach.

SCOPE OF INTERMEDIARY SERVICES

To be effective, intermediaries should offer a set of value adding services that are neither too broad nor too narrow, and for which there is a real market.

An optimum strategy to accomplish this within the resource constraints facing most offices is to offer a small portfolio (3-5) of core services through in-house personnel having in-depth knowledge in these areas. Services outside this core can then be provided through referral to competent outside service providers.

TRADEOFFS: UNDERSTANDING THE MARKETS VS. UNDERSTANDING THE TECHNOLOGY

It is not critical that all personnel participating in a tech transfer project completely and totally understand every aspect of the technology. A major value-adding benefit of a tech transfer office is in-depth assessment of the market potential of new technology invented at the institution. While this requires a basic understanding of the technology, it requires above all an appreciation for the marketplace.

The tech transfer office should thus focus its limited resources on comprehensive identification of marketable applications and potential licensees, while building a strong partnership with the inventor and other researchers toward understanding the benefits and limits of the technology itself.

COMMUNICATING THE MESSAGE

Public sector institutions (i.e., federal/university laboratories) are not effectively communicating their capabilities and available resources. Generally, they do not possess the expertise internally to perform this aspect of the marketing function.

Thus, the public sector should contract with private sector marketing organizations to provide services such as defining (potential) markets, developing effective message content, identifying methods to perform market analysis and guage market response and choosing the most appropriate media to reach a specific market.

APPENDIX I

THE SURVEY RESPONDENTS

The survey included a brief section: "Tell us about yourself." From this we were able to develop a clear picture of the type, scope and very basic operational aspects of the respondents. In certain cases the entries may not add up to the total of 45 responses received because not all respondents answered every question.

1. Type of organization

Tech Transfer Intermediary	17
National/Federal Laboratory	6
University	13
Large Company	4
Small Company*	5

*Defined as gross sales of $50M or less per year.

2. Public sector vs private sector

Public Sector	22
Private Sector	23

3. Years involved in tech transfer activities

Less than 5 years	9
Between 5 - 20 years	20
More than 20 years	15

4. Number of tech transfer projects ongoing in the organization at any one time

Less than 3 projects	10
3-20 projects	11
More than 10 projects	21

5. Funding mechanisms

Internal means	22
External means	20
Both internal and external	3

6. Change in the volume of tech transfer projects projected in next three years

About the same number of projects	3
Twice the current number of projects	23
At least three times the current number	17

APPENDIX 2

EXCERPTS FROM THE SURVEY

To provide a flavor for the best practices survey and the responses to it, we include here the text of the preamble to each section, the numerical responses to representative candidate best practice statements and a summary of the more illuminating comments received in the context of these statements.

STRATEGY/POLICY

PREAMBLE: Technology transfer is a complex, sometimes controversial activity that can benefit from the kind of careful long range strategic planning routinely carried out by the best internationally competitive companies. Every R&D institution must formulate a strategic plan for technology transfer and integrate it into the overall strategy/policy/business plan for the institution. This strategic plan must be 'owned' by all levels of the organization. Like the strategic/business plans adopted by private industry, the technology transfer strategic/business plan must identify as clearly as possible its products (the range of technologies to be transferred) and its customers (the market segments to be addressed).

Statement: In most, if not all, tech transfer projects, project success depends on the development of strong partnerships, both internal and external where trust, respect and communication form the bond.

28 Strongly Agree   13 Agree   2 Disagree   0 Strongly Disagree

Representative comments:
a. "If trust and respect are present many problems melt away. If not, the deal will usually fail."
b. "Trust, respect and communication may be necessary, but they are not sufficient. A shrewd economic interest is required."

Statement: Statewide public sector tech transfer offices should place a personal representative permanently inside nearby federal laboratories to assist with tech transfer from within the laboratory aimed at local economic development.

4 Strongly Agree   17 Agree   18 Disagree   1 Strongly Disagree

Representative comments:
a. **"Have liaison people, but no need to 'place at laboratories.'"**
b. **"Linkages between labs and state agencies are pretty awful."**
c. **"Good idea! But be careful of personnel selected. (Must be highly qualified.)"**
d. **"I think this would have limited effectiveness."**
e. **"This is a good idea, but do statewide programs have the funds to devote to a person to such a narrow task?"**

Statement: In order to play an effective role, a tech transfer intermediary should limit the range of technical areas in which it is active, to those fields in which it has in-house technical expertise.

7 Strongly Agree 16 Agree 17 Disagree 3 Strongly Disagree

Representative comments:
a. "Our ORTA can direct businesses to other labs who do the work even if their own lab does not."
b. "Too many 'content free' brokers.
c. "Then one might miss some important new technical areas."
d. "The intermediary may not need any technical expertise at all. Must understand business, however."
e. "Too limiting! This is how to behave like a 'dinosaur' industry! Look to the future, not the past! By the way, having in-house technical expertise is one of the least important aspects of t^2, what is more important is having access to qualified technical specialists when required, as well as having good in-house marketing and product development expertise."
f. "Needs to be broader and dependent on linked expertise through partners."

COMMUNICATION/ORGANIZATION

PREAMBLE: Effective technology transfer requires the use of the standard project management and communication best practices common to any well-run entity, including careful attention to specific problem definition, the use of cross-functional teams and formalized project tracking (e.g. GANTT, Pert charts) with the responsibilities to all parties clearly defined in legally supportable written documentation.

Statement: Public sector institutions and laboratories must be conscious that companies will show little interest in licensing their technologies unless the technology translates into a profitable product or process with an economic benefit.

22 Strongly Agree 20 Agree 1 Disagree 0 Strongly Disagree

Representative comments:
a. "That is the name of the game for industry."
b. "Bottom line result to make the difference."
c. "Economic feasibility studies are necessary."
d. "And their marketing approach must reflect this consciousness."

Statement: The most effective instrument yet devised for defining joint development relationships and responsibilities between private sector companies and federal laboratories is the CRADA.

3 Strongly Agree 18 Agree 11 Disagree 6 Strongly Disagree

Representative comments:
a. "Agree, but not strongly – CRADAs are still too slow and bureaucratic and lawyers can really slow things down."

b. "The CRADA is a legislative authorization. Its implementation varies widely, i.e. NIST-DOE".
c. "CRADAs as currently constructed are too frequently legal/bureaucratic nightmares."
d. "So far it's all we have!"
e. "Emphasis on "defining" these relationships. Effectiveness of such relationships and success in development and transfer – jury is still out on this."
f. "CRADAs are bs! They are OK for funding, but I'm not sure what they do for tech transfer."
g. "Usually the CRADA is not what the business really wants."
h. "It is one of the most effective tools, but the best medium for tech transfer remains the personal relationships between technical staff in the lab and in the private sector."

INVENTORY

PREAMBLE: As part of "general best business practices", all tech transfer entities should maintain an inventory of their facilities, capabilities and strengths and pursue strategies which capitalize on these strengths.

Statement: Successful technology-based companies must be continuously aware of emerging technology that could impact their market.

25 Strongly Agree   16 Agree   3 Disagree   0 Strongly Disagree

Representative comments:
a. "Couldn't agree more – we've seen this in the medical technology arena."
b. "Also, impact their production technologies."
c. "SWOT analysis!"

Statement: Organizations seeking to enter into tech transfer projects with small manufacturing businesses should have internal capabilities that include expertise in the areas of CAD and manufacturing systems that can help solve routine production problems and improve productivity.

2 Strongly Agree   18 Agree   16 Disagree   2 Strongly Disagree

Representative comments:
a. "Community colleges can do this quite well."
b. "Not our job."
c. "Yes, but that's not the only useful expertise."
d. "These are different domains of activity by my definition; CAD upgrades are handled by extension/MTC programs; tech transfer by intellectual property folk."

Statement: All research institutions or R&D departments should be put through a technical audit every 2-3 years for the purpose of identifying non-productive R&D activity.

4 Strongly Agree   21 Agree   13 Disagree   4 Strongly Disagree

Representative comments:
a. "...but controversial and how do you judge 'non-productive' R&D activity-papers, reports, licenses, or what."

b. "Purpose is wrong-we don't tell faculty what to do-if they are unproductive, that's their problem-eventually they lose their external funding. You audit every two or three years to uncover useful technology not disclosed to you."
c. "How is non-productive activity defined? Commercial participants vote with their dollars and other resource commitments."
d. "This is a risky issue and often is controlled by a parent agency."
e. "Measured against what?"
f. "What is 'non-productive R&D activity?' Since research is generally funded by outside sources, they are audit of productivity. Audits of non-productivity are generally made yearly during investigator evaluation."
g. "Its a necessary evil that weeding must be done or you will erode your resources."
h. "But it's difficult to assess 'productive R&D', in some cases in 3 years of 'research' effort."

MARKET ASSESSMENT

PREAMBLE: All institutions that develop technology must have in place some mechanism for assessing its market potential. Institutions which assume that their technologies will "sell themselves", without further refinement, are usually disappointed.

Statement: Public sector research institutions must build market bridges to the private sector.

17 Strongly Agree **25 Agree** **2 Disagree** **0 Strongly Disagree**

Representative explanations:
a. "This is absolutely critical to the successful commercialization of university technology."
b. "Not only market bridges but technical bridges."
c. "That is technology push."

Statement: When public sector research organizations or large private sector organizations attempt to transfer technology to existing small businesses, they must recognize the resource and technology constraints of the small business and work with it to effectively overcome them in order to successfully commercialize the technology.

12 Strongly Agree **29 Agree** **3 Disagree** **0 Strongly Disagree**

Representative comments:
a. "To the extent that they themselves aren't resource-constrained."
b. "The public sector organizations might designate specific 'small business liaison' officers to work things out."
c. "I'm not sure it is the job of the labs to facilitate commercialization. That is the job of service providers. Labs can help in some ways."
d. "Generally, workloads of tech transfer professions at large public sector organizations don't have time. The constraints factor into licensee selection and often eliminate small businesses."
e. "Small companies are disasters waiting to happen. Labs/universities need to realize this."

Statement: Small companies desiring new technology should regularly attend federal laboratory meetings such as those sponsored by the Federal Lab Consortium (FLC).

2 Strongly Agree 18 Agree 18 Disagree 4 Strongly Disagree

Representative comments:

a. "These meetings (to date) have been geared to large companies. Also, key personnel in small companies are too busy running the firm to attend meetings. Visits to the firm by 'extension' agents may be the answer."
b. "They should visit the labs and get to know the R&D staff."
c. "As currently configured, these meetings suck and will turn off small companies."
d. "These are generally a waste of time."

RESOURCES

PREAMBLE: Successful technology transfer requires unavoidable up-front commitment of money, people and time. Given that these resources will always be limited, the question becomes, "How do we acquire, maintain, optimize, protect and generally best utilize the resources we know we must have?"

Statement: All inherently risky activities, including technology transfer, require someone to "champion the cause".

26 Strongly Agree 15 Agree 3 Disagree 0 Strongly Disagree

Representative comments:

a. "There must be a commitment to persist through difficult times."
b. "Without a champion at a senior level (in the University), no progress of long-term value will take place."
c. "No champion - no success!"
d. "Usually, someone on the 'inside'."

Statement: Because of the lag time between the licensing of intellectual property and the receipt of royalties, universities must be prepared to provide an appropriate, consistent level of resources to offset the overhead cost of their tech transfer offices, which may not turn "profitable" for months or even years.

11 Strongly Agree 31 Agree 1 Disagree 0 Strongly Disagree

Representative comments:

a. "It's not 'may' and it's not months. Should read 'which predictably will not operate in the black for 5-8 years'."
b. "May never be profitable-shouldn't focus on income as the only measure of success."

REWARD/RECOGNITION

PREAMBLE: A tech transfer project or organization, like any well managed project or organization in any field, must have a well thought out reward system that drives the desired organizational behavior, builds a team approach and fairly recognizes the contributions from all members of the team.

Statement: Rather than relying on penalties alone, the most effective way to do this is to provide exceptional and critical value-added services through the tech transfer office such that the faculty inventor is better off using the office than attempting to bypass it.

15 Strongly Agree 26 Agree 2 Disagree 0 Strongly Disagree

Representative comments:
a. "Very important. Provide a 'value added' market/finance analysis service for inventor."
b. "In order for this not to happen, some value-added service must be provided by the office."
c. "Provided office is a benefit and not an obstacle."
d. "They need experienced advisors."
e. "Unless the tech transfer office is simply another ineffective bureaucratic entity."
f. "Good luck. Really it's the t^2 offices' task to constantly demonstrate its utility and user friendliness."
g. "However, it is difficult to work with many university administrators so that it becomes counter-productive to get a technology 'bottlenecked' in the legal and political constraints within the university."

Statement: Faculty members are encouraged by university policies to spend a significant portion of their work-week on tech transfer activities.

1 Strongly Agree 18 Agree 18 Disagree 4 Strongly Disagree

Representative comments:
a. "Better to have a key person in each department to work on tech transfer (not full-time)."
b. "It does not take a significant effort."
c. "Some faculty are not interested. There must be a sense of determination."
d. "Tech transfer is not very important to many universities. They give 'lip service'; however, faculty are not rewarded beyond their research endeavors."
e. "Should never be more than 10-20% of their time."
f. Should not interfere with normal research."
g. "'Significant' I can't buy. A reasonable portion of their research-related activities."
h. "Dream on!"
i. "It should be up to them."
j. "As long as this is 'reasonable'."

Statement: The tech transfer office should position itself to minimize potential conflict between the research and technology transfer mission of the university.

9 Strongly Agree 33 Agree 1 Disagree 0 Strongly Disagree

Representative comments:
a. "Should be part of the university's mission."
b. "Manage conflict, prepare for, discourage, avoid egregious behavior--but don't aim at zero conflict--then nothing will result."
c. "This is critical -- inflexible tech transfer policies cannot drive the research enterprise! You simply can't turn down research funding because of terms for an invention which may or may not be developed somewhere in the future."

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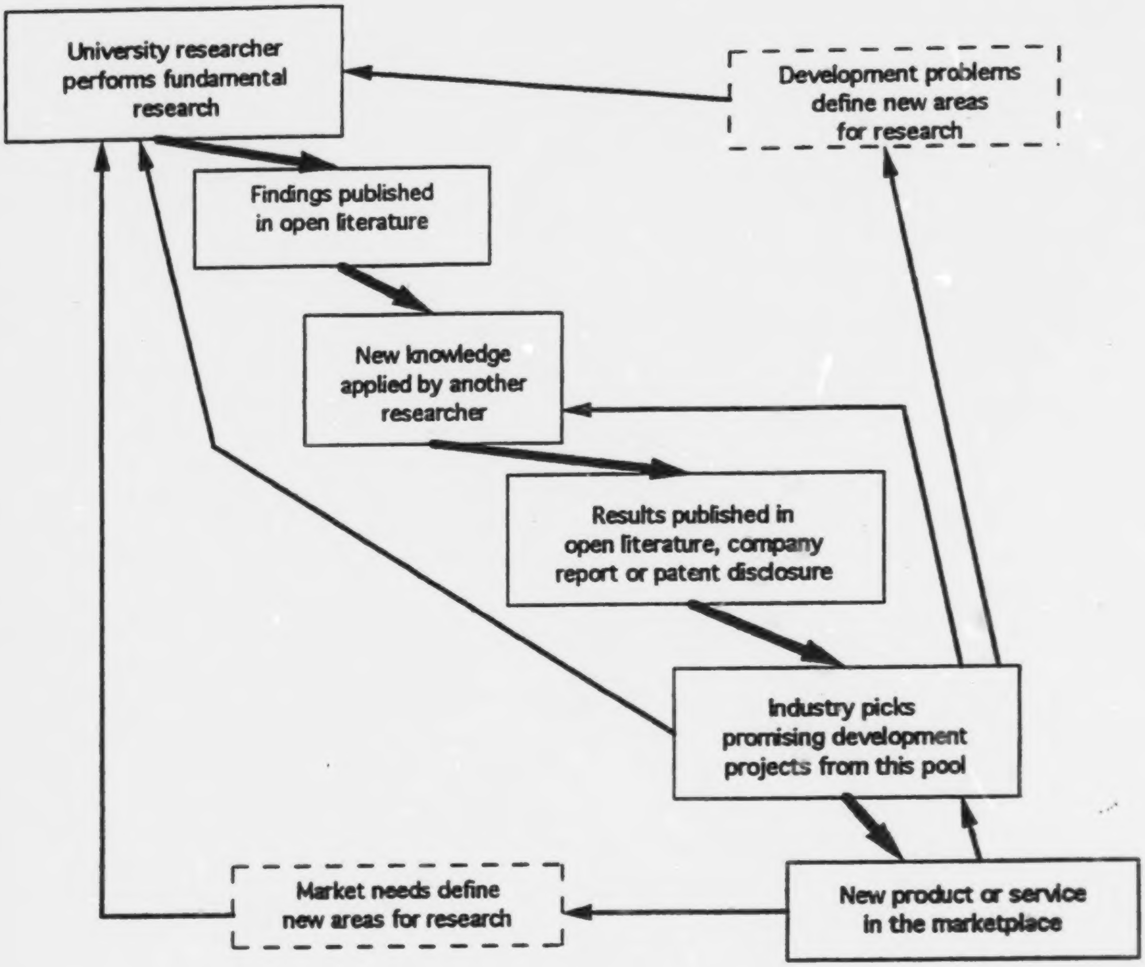

University researcher performs fundamental research
Development problems define new areas for research
Findings published in open literature
New knowledge applied by another researcher
Results published in open literature, company report or patent disclosure
Industry picks promising development projects from this pool
Market needs define new areas for research
New product or service in the marketplace

Fig. 1 Activity flow in the transfer of University technology

BEST COPY AVAILABLE

III. BEST PRACTICES SURVEY INSTRUMENT WITH RAW DATA

A. TELL US ABOUT YOURSELF*

1) What type of organization are you?

public sector
private sector

2) What is the primary role of your organization?

seller of technology
buyer of technology
tech transfer intermediary
we are not involved in technology transfer

3) How would you classify your organization's research/commercialization activities?

basic technical research
applied technical research
full commercialization to the marketplace
research and/or training in tech transfer
tech transfer intermediary

4) How many years has your organization been involved in tech transfer activities?

less than 5 years
between 5-20 years
more than 20 years

5) What is the scale of tech transfer projects in which your organization is primarily involved?

less than 1,000 man-hours (small)
between 1,000-10,000 man-hours (medium)
more than 10,000 man-hours (large)

6) How many tech transfer projects are ongoing in your organization at any one time?

less than 3 tech transfer projects
3-10 tech transfer projects
more than 10 tech transfer projects

7) What change in the volume of tech transfer projects do you see in your organization three years from now?

less than the current number of tech transfer projects
twice the current number of tech transfer projects
at least three times the current number of tech transfer projects

8) By what means does your organization primarily fund its tech transfer projects?

internal means
external means

---

*See Appendix I, "The Survey Respondents," included with Section II for statistics on respondents.

B. STRATEGY/POLICY

PREAMBLE

Technology transfer is a complex, sometimes controversial activity that can benefit from the kind of careful long range strategic planning routinely carried out by the best internationally competitive companies. Every R&D institution must formulate a strategic plan for technology transfer and integrate it into the overall strategy/business plan for the institution. This strategic plan must be "owned" by all levels of the organization. Like the strategic/business plans adopted by private industry, the technology transfer strategic/business plan must identify as clearly as possible its products (the range of technologies to be transferred) and its customers (the market segments to be addressed).

Generally agree **Generally disagree**

TECH TRANSFER OFFICE STRATEGY/POLICY

1. Survey results suggest that the management in both federal labs and, to a lesser extent, universities still view their tech transfer activities primarily in terms of enhanced public image rather than in terms of economic benefit and rewards to their institutions, their people and the community. For long term success, tech transfer must be integrated into an economically driven strategic plan and not treated as a public relations veneer.

21 **Strongly Agree** 21 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

2. As part of its tech transfer strategic plan, every institution must formulate a consistent set of guidelines and a decision-making methodology to deal with such issues as:

What, where and when to patent
What activities to pursue "in-house" and which to "farm out"
When to seek royalties and when to seek equity

16 **Strongly Agree** 25 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

3. A new tech transfer office, in particular, with limited resources, should carefully consider utilizing private sector brokers to evaluate invention disclosures, obtain patents when appropriate, find licensees and negotiate licenses.

10 **Strongly Agree** 18 **Agree** 13 **Disagree** 3 **Strongly Disagree**
Please explain your position:

4. When negotiating an agreement with a technology broker, the university should reserve the right to withhold from the broker specific products or technologies from the broker that it may want to pursue itself.

12 **Strongly Agree** 22 **Agree** 5 **Disagree** 2 **Strongly Disagree**
Please explain your position:

5. To attain consistent tech transfer project success, university tech transfer offices must find and retain experienced staff, engage in intermediate- and long-term planning and continually evaluate their output of services.

21 **Strongly Agree** 22 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

6. A tech transfer office may operate in a passive mode (let technology buyers and sellers come to it), an active mode (beat the bushes for new technologies; aggressively seek potential buyers), or it may seek an outside party to do the marketing (broker mode).

9 **Strongly Agree** 21 **Agree** 9 **Disagree** 2 **Strongly Disagree**
Please explain you position:

7. In general, the best approach is to develop a hybrid strategy that provides the flexibility to effectively interface with the environment and fully utilize all the available resources.

17 **Strongly Agree** 18 **Agree** 6 **Disagree** 0 **Strongly Disagree**
Please explain you position:

8. There is no fixed formula for tech transfer success. Each tech transfer project must be treated flexibly in the environment in which it occurs.

15 **Strongly Agree** 27 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

9. All organizations involved in tech transfer projects should adopt a combined technology push/market pull approach for the best chance of success.

15 **Strongly Agree** 25 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

10. A tech transfer office must have a structured set of invention evaluation policies that is aligned with the university's tech transfer philosophies and resources.

9 **Strongly Agree** 30 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position:

11. If an evaluation points to patent and/or license, the university must clearly state the "type" and "amount" of resources it is willing to commit during the pre-and post-license periods.

7 Strongly Agree 23 Agree 11 Disagree 1 Strongly Disagree
Please explain your position:

12. Most institutions require their faculty/staff to assign all inventions to the institution as a condition of employment. Academic institutions should consider granting inventors the option of retaining title to their invention so they remain free to commercialize it themselves. A well-formulated tech transfer program would then be one which had the capability to add so much value that most inventors would gladly go through the tech transfer office and assign their rights to the university.

2 Strongly Agree 18 Agree 16 Disagree 6 Strongly Disagree
Please explain your position:

13. When a university perceives that it has made a "landmark" discovery, it should not only engage in licensing but also take an equity interest in the licensee.

3 Strongly Agree 22 Agree 14 Disagree 0 Strongly Disagree
Please explain your position:

14. It is the responsibility of the tech transfer office to fully ascertain and disclose whether there are any impediments to the licensing of technology. For example, it is important to clearly establish whether an institution has "clear title" to a specific technology.

21 Strongly Agree 20 Agree 3 Disagree 0 Strongly Disagree
Please explain your position:

15. Long-term research is an important component to the overall tech transfer program strategy because it brings dollars into the program/university and creates a pool of new ideas available to industry.

12 Strongly Agree 28 Agree 3 Disagree 1 Strongly Disagree
Please explain your position:

16. To gain faculty support, university affiliated tech transfer offices must continuously help to bring research dollars into the institution, as well as send technology out into the marketplace.

9 Strongly Agree 21 Agree 12 Disagree 1 Strongly Disagree
Please explain your position:

17. Successful technology transfer requires significant risk-taking on the part of public sector technology suppliers, and the handling of issues such as possible misuse of resources and conflicts of interest on a case-by-case basis rather than by blanket proscriptions.

9 **Strongly Agree** 24 **Agree** 8 **Disagree** 2 **Strongly Disagree**
Please explain your position:

18. Federal agencies must delegate tech transfer authority to lower levels in individual labs as a way to overcome perceived bureaucratic red tape.

10 **Strongly Agree** 18 **Agree** 10 **Disagree** 2 **Strongly Disagree**
Please explain your position:

TOOLS

19. Any effective strategic plan must have a supporting "toolkit" available that is comprised of policies and procedures.

10 **Strongly Agree** 25 **Agree** 8 **Disagree** 0 **Strongly Disagree**
Please explain your position:

20. For example: A tech transfer organization should center itself around Total Quality Management concepts and develop specific mechanisms such as evaluations and certifications in order to implement its strategic plan.

3 **Strongly Agree** 22 **Agree** 13 **Disagree** 3 **Strongly Disagree**
Please explain your position:

21. Public sector institutions that participate in applied research and provide technical assistance should utilize, where appropriate, private sector business practices such as TQM, cross-functional teams and continuous improvement methodologies.

10 **Strongly Agree** 23 **Agree** 8 **Disagree** 1 **Strongly Disagree**
Please explain your position:

22. Public and private sector tech transfer offices should integrate systematic intermediate- and long-term planning and evaluation mechanisms into their operations.

13 **Strongly Agree** 28 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

23. Benchmarking of the highest priority activities against other institutions' corresponding key tech transfer processes should be done on a long-term basis.

6 **Strongly Agree** 31 **Agree** 2 **Disagree** 1 **Strongly Disagree**
Please explain your position:

24. Public research institutions and laboratories must develop a standardized technology evaluation process focusing on marketplace potential, to assist in such strategic decisions as the "type" or "amount" of additional resources that are required to make the technology commercially viable.

9 **Strongly Agree** 22 **Agree** 10 **Disagree** 2 **Strongly Disagree**
Please explain your position:

25. All public sector, technology-oriented institutions, should develop a relatively simple standardized pre-certification system for companies wishing to license their technologies.

6 **Strongly Agree** 19 **Agree** 15 **Disagree** 2 **Strongly Disagree**
Please explain your position:

26. As tech transfer emerges as a well-structured discipline, more specific tools are becoming available. To be successful, the tech transfer office must actively seek out and deploy such tools.

13 **Strongly Agree** 25 **Agree** 4 **Disagree** 2 **Strongly Disagree**
Please explain you position:

For example:

a) the standardized Cooperative Research and Development Agreement (CRADA) now widely used to define federal lab/private sector interactions

6 **Strongly Agree** 23 **Agree** 7 **Disagree** 3 **Strongly Disagree**
Please explain you position:

b) a number of online databases which feature available technology and technologists

9 **Strongly Agree** 27 **Agree** 3 **Disagree** 2 **Strongly Disagree**
Please explain you position:

PARTNERS/PARTNERSHIPS

27. In most, if not all, tech transfer projects, project success depends on the development of strong partnerships, both internal and external where trust, respect and communication form the bond.

28 **Strongly Agree** 13 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

28. No company today, no matter how large, can generate internally all the new technology it needs to be competitive. It must seek out scientific insight worldwide and be willing to provide funding and other resources to leading researchers and scientists around the world.

18 **Strongly Agree** 25 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

29. When federally developed technology is sought by the private sector and there are no issues of national security, the private sector should be free to pursue foreign capital/partnerships to facilitate the transfer and commercialization of the technology as long as there is net benefit to the U.S.

12 **Strongly Agree** 23 **Agree** 4 **Disagree** 1 **Strongly Disagree**
Please explain your position:

30. It is important for any organization embarking on a new technology commercialization project to decide up front when and with whom to partner.

2 **Strongly Agree** 22 **Agree** 16 **Disagree** 4 **Strongly Disagree**
Please explain your position:

31. A small organization with limited resources should consider participation in a number of smaller tech transfer projects rather than a single large one.

0 **Strongly Agree** 21 **Agree** 18 **Disagree** 2 **Strongly Disagree**
Please explain you position:

32. It is critical that the university or federal laboratory establish private sector stakeholding early in the tech transfer project. For example, to help unearth "market pull", tech transfer offices should solicit project proposals from companies and use them as a basis for partnering discussions.

9 **Strongly Agree** 25 **Agree** 7 **Disagree** 2 **Strongly Disagree**
Please explain your position:

33. An effective means to commercialize university-generated technology is through the formation of a holding company which can identify R&D with commercial potential and initiate new companies, as appropriate.

1 **Strongly Agree** 23 **Agree** 13 **Disagree** 3 **Strongly Disagree**
Please explain your position:

34. As a matter of policy, these holding companies should provide support and practical assistance to their offspring for as long as required.

3 Strongly Agree 21 Agree 10 Disagree 5 Strongly Disagree
Please explain your position:

35. It should be standard operating procedure for university-owned holding companies to forge partnerships between their startups and large, established companies whose commercial capabilities complement the startup's technical and innovating capability.

3 Strongly Agree 16 Agree 17 Disagree 2 Strongly Disagree
Please explain your position:

36. In certain tech transfer projects, it may be appropriate for a university to locate and utilize venture capital firms as intermediaries to develop startup firms.

7 Strongly Agree 28 Agree 6 Disagree 1 Strongly Disagree
Please explain your position:

37. An effective methodology that increases the long-term success of the tech transfer process is to view all the participants as partners in a strategic alliance that never fully terminates even after a specific tech transfer event is concluded.

10 Strongly Agree 24 Agree 9 Disagree 0 Strongly Disagree
Please explain your position:

COMMUNITY OUTREACH

38. Universities and federal labs have a special responsibility to reach out to their local region.

14 Strongly Agree 20 Agree 6 Disagree 1 Strongly Disagree
Please explain your position:

39. Universities should periodically audit their resources and assets in an attempt to keep them closely aligned with the economic development needs of their community, region or state, as well as with their own priorities.

12 Strongly Agree 24 Agree 6 Disagree 1 Strongly Disagree
Please explain your position:

40. Universities should have comprehensive community outreach policies which encourage faculty members to engage in technical exchanges with the organizations that support their institution.

13 Strongly Agree 28 Agree 1 Disagree 0 Strongly Disagree
Please explain your position:

41. It is good general strategy and sometimes particularly economically attractive for a company specializing in a given technology to locate in proximity to public research institutions or laboratories that share the same areas of interest and expertise.

11 **Strongly Agree** 30 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

42. For example, some federal laboratories offer more favorable licensing terms to firms willing to relocate nearby.

3 **Strongly Agree** 20 **Agree** 13 **Disagree** 1 **Strongly Disagree**
Please explain your position:

43. To assist local companies in establishing a cooperative research arrangement with it, a given federal laboratory should adopt a deliberate policy of permitting a lower percentage of matching funds from that local company, particularly for the first one or two projects negotiated.

3 **Strongly Agree** 13 **Agree** 19 **Disagree** 3 **Strongly Disagree**
Please explain your position:

44. Universities should consider establishing research parks as a means to attract private sector operations that enhance university research programs and create local economic development.

5 **Strongly Agree** 22 **Agree** 10 **Disagree** 3 **Strongly Disagree**
Please explain your position:

45. Statewide public sector tech transfer offices should place a personal representative permanently inside nearby federal laboratories to assist with tech transfer from within the laboratory aimed at local economic development.

4 **Strongly Agree** 17 **Agree** 18 **Disagree** 1 **Strongly Disagree**
Please explain your position:

46. An alliance of business, government and academia is necessary to develop the appropriate incentives and rewards that lead to continuing technology-driven economic development.

16 **Strongly Agree** 22 **Agree** 5 **Disagree** 1 **Strongly Disagree**
Please explain your position:

APPROACHES AND OPTIONS: INTERMEDIARIES/PEOPLE

47. To receive external technology effectively, a large company must have in place a research front end that is attuned to the product/process development cycle and free of the "not invented here" syndrome.

13 **Strongly Agree** 25 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position:

48. In order to play an effective role, a tech transfer intermediary should limit the range of technical areas in which it is active to those fields in which it has in-house technical expertise.

7 **Strongly Agree** 16 **Agree** 17 **Disagree** 3 **Strongly Disagree**
Please explain your position:

49. Cross disciplinary teams can achieve effective tech transfer in a university setting, cutting across the barriers between conventional university disciplines.

9 **Strongly Agree** 30 **Agree** 2 **Disagree** 1 **Strongly Disagree**
Please explain your position:

50. Personnel exchange agreements should be standard operating procedure among partners in the technology transfer process.

5 **Strongly Agree** 26 **Agree** 11 **Disagree** 0 **Strongly Disagree**
Please explain your position:

C. COMMUNICATION/ORGANIZATION

PREAMBLE

Effective technology transfer requires the use of the standard project management and communication best practices common to any well-run entity, including careful attention to specific problem definition, the use of cross-functional teams and formalized project tracking (e.g. GANTT, Pert charts) with the responsibilities of all parties clearly defined in legally supportable written documentation.

Generally agree Generally disagree

BRIDGING THE COMMUNICATION AND CULTURAL GAPS

1. All organizations engaging in tech transfer projects must clearly articulate their policies and regulations, both internally to their employees and externally to their customers.

13 **Strongly Agree** 27 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position :

2. Tech transfer intermediaries can be utilized as a communication and training mechanism to educate scientists and engineers on patent issues and how to work within the organizations' tech transfer philosophy.

7 **Strongly Agree** 30 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position :

3. There is a fundamental cultural and communication disconnect between technology-driven public sector researchers and market-results-driven private sector business decision makers.

10 **Strongly Agree** 27 **Agree** 5 **Disagree** 2 **Strongly Disagree**
Please explain your position :

4. Public sector institutions and laboratories must be conscious that companies will show little interest in licensing their technologies unless the technology translates into a profitable product or process with an economic benefit.

22 **Strongly Agree** 20 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain you position:

5. The public and private sectors must consider the two tremendously different cultures in which they each exist and must be willing to exercise patience and creativity in building solid relationships.

17 **Strongly Agree** 24 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position :

Given your responses in nos. 3-5 :

6. Public sector technology sources must develop and implement communication vehicles that document tech transfer opportunities in a manner that is compelling to the industrial/investment community.

11 **Strongly Agree** 32 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position :

7. There is a role for tech transfer intermediaries in bridging the gap between scientists who communicate through technical reports and industrialists/investors who communicate through business plans and financial documents to make decisions about investment in technology.

9 **Strongly Agree** 32 **Agree** 1 **Disagree** 1 **Strongly Disagree**
Please explain your position :

8. To reduce the "culture gap" problem, private sector companies, especially small ones, wishing to establish a relationship with a federal laboratory should seek out laboratories that emphasize programmatic development rather than basic research because such labs work routinely with private sector organizations and present fewer cultural disconnects.

1 **Strongly Agree** 23 **Agree** 14 **Disagree** 1 **Strongly Disagree**
Please explain your position :

9. To be effective in collectively serving their private sector clients, university, state, federal and private sector technology transfer intermediaries must network aggressively among themselves.

8 **Strongly Agree** 29 **Agree** 4 **Disagree** 1 **Strongly Disagree**
Please explain your position :

10. As part of a market pull communication process, the private sector must maintain steady pressure on the federal government to open its labs to collaborations with the private sector and to provide resources to the labs to make this happen.

8 **Strongly Agree** 28 **Agree** 5 **Disagree** 1 **Strongly Disagree**
Please explain you position:

11. To facilitate dialog between private sector and public sector institutions and laboratories, relatively fast and easy "entry documentation" should be put in place to be used during the introductory phases of a potential tech transfer project.

8 **Strongly Agree** 32 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position :

12. The most effective instrument yet devised for defining joint development relationships and responsibilities between private sector companies and federal laboratories is the CRADA.

3 **Strongly Agree** 18 **Agree** 11 **Disagree** 6 **Strongly Disagree**
Please explain your position :

13. Federal laboratories should build communication contacts at the state and local levels by using intermediaries such as community colleges, vocational-technical schools, state agencies and local university-based tech transfer intermediaries.

7 **Strongly Agree** 29 **Agree** 6 **Disagree** 0 **Strongly Disagree**
Please explain your position :

14. Jointly developed tech transfer demonstration projects are an effective way to establish and maintain communication among public sector tech transfer entities.

2 **Strongly Agree** 33 **Agree** 5 **Disagree** 1 **Strongly Disagree**
Please explain your position :

15. Because person-to-person contact at the technical level is so important to effective tech transfer, university and federal laboratory researchers should be encouraged to network extensively. For example, researchers, faculty and scientists should be required to attend national and international meetings and conferences in their area(s) of expertise, at least annually.

8 **Strongly Agree** 22 **Agree** 10 **Disagree** 2 **Strongly Disagree**
Please explain your position :

16. The employment of students at university-based tech transfer offices provide them with the opportunity to move into excellent industrial jobs, introduce their prospective employers to potential tech transfer projects and serve as an effective publicity vehicle for the tech transfer office.

8 **Strongly Agree** 22 **Agree** 10 **Disagree** 2 **Strongly Disagree**
Please explain your position :

TECHNOLOGY TRANSFER DATABASES

17. Searching for a particular topic (technology) in the public sector research institutions and laboratories is accomplished today by reviewing topical literature, professional society journals, newsletters and through such contacts as the National Technical Information Service (NTIS), the Office of Science and Technology Information (OSTI), the Federal Laboratory Consortium (FLC) and various private sector for-profit databases. A more integrated "one-stop-shopping" approach is desperately needed.

12 Strongly Agree 17 Agree 11 Disagree 3 Strongly Disagree
Please explain your position :

18. Universities should list their new technologies in an electronically scanable database that, ideally, would be integrated with those featuring federal technology.

5 Strongly Agree 32 Agree 5 Disagree 1 Strongly Disagree
Please explain your position :

19. Federal and state organizations must develop, manage and maintain an integrated electronic information network that opens communication between federal laboratories, academic institutions and private sector businesses, large and small.

6 Strongly Agree 25 Agree 9 Disagree 2 Strongly Disagree
Please explain your position :

20. To be effective, intermediaries need initial access to the technical expertise of a given federal lab through a single point of contact.

3 Strongly Agree 23 Agree 14 Disagree 3 Strongly Disagree
Please explain your position :

21. The lab's tech transfer office must maintain a comprehensive database for use by this contact person as well as for other purposes.

8 Strongly Agree 26 Agree 4 Disagree 3 Strongly Disagree
Please explain your position :

D. INVENTORY

PREAMBLE

As part of "general best business practices," all tech transfer entities should maintain an inventory of their facilities, capabilities and strengths and pursue strategies which capitalize on these strengths.

Generally agree **Generally disagree**

KNOWING WHAT TECHNOLOGY TO INVENTORY

1. With some technologies, a university may determine that it does not have the knowledge or resources to bring a technology to a state of maturation where it can be readily transferred.

12 **Strongly Agree** 30 **Agree** 1 **Disagree** 1 **Strongly Disagree**
Please explain your position :

2. In such cases, the university should partner with a large company that has the front-end depth to accept immature technology and grow it.

7 **Strongly Agree** 24 **Agree** 8 **Disagree** 2 **Strongly Disagree**
Please explain your position :

3. Successful technology-based companies must be continuously aware of emerging technology that could impact their market.

25 **Strongly Agree** 16 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position :

4. These companies must perform some inventory maintenance that includes networking with public sector research institutions and laboratories to keep abreast of technology progression and direction.

15 **Strongly Agree** 25 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position :

INVENTORY: MEETING CUSTOMER NEEDS

5. A successful tech transfer office must demonstrate an in-depth knowledge of how a private sector company transforms external knowledge into a useful new product or service.

15 **Strongly Agree** 17 **Agree** 12 **Disagree** 0 **Strongly Disagree**
Please explain your position :

6. Organizations attempting to enter into tech transfer projects with federal laboratories must possess the strengths and resources to overcome cultural, behavioral, logistical and financial barriers.

9 **Strongly Agree** 28 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position :

7. Tech transfer intermediaries can assist in this process by translating between cultures and, in the case of small companies, by providing assistance in obtaining financing and working logistical issues.

11 **Strongly Agree** 24 **Agree** 7 **Disagree** 0 **Strongly Disagree**
Please explain your position :

8. To effectively address the technology needs of small business, federal technology extension services, such as NIST's Manufacturing Technology Centers, should focus on those capabilities which provide their client with proven technologies as opposed to leading-edge science.

11 **Strongly Agree** 19 **Agree** 11 **Disagree** 1 **Strongly Disagree**
Please explain your position:

9. Organizations seeking to enter into tech transfer projects with small manufacturing businesses should have internal capabilities that include expertise in the areas of CAD and manufacturing systems that can help solve routine production problems and improve productivity.

2 **Strongly Agree** 18 **Agree** 16 **Disagree** 2 **Strongly Disagree**
Please explain your position:

INVENTORY: PUBLICITY

10. All research institutions should maintain, both electronically and on paper, an inventory of their capabilities, areas of expertise of their personnel, and specialized research facilities.

12 **Strongly Agree** 29 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

11. An inventory of corporate/laboratory technology assets can be used both for internal purposes and as a way to identify technology suitable for external licensing.

8 Strongly Agree 35 Agree 1 Disagree 0 Strongly Disagree
Please explain your position:

12. All colleges and departments within a university that have the potential to make contributions toward the overall tech transfer mission of the university should publicize the resources and services available that could facilitate the development and marketing of university-generated technology.

6 Strongly Agree 31 Agree 5 Disagree 1 Strongly Disagree
Please explain your position:

INVENTORY: EVALUATION

13. Public research institutions must realistically and carefully appraise what they have to offer -- benchmarking their capabilities against the best of their peers, worldwide, is a useful vehicle for doing this.

4 Strongly Agree 27 Agree 11 Disagree 0 Strongly Disagree
Please explain your position:

14. All research institutions or R&D departments should be put through a technical audit every 2-3 years for the purpose of identifying non-productive R&D activity.

4 Strongly Agree 21 Agree 13 Disagree 4 Strongly Disagree
Please explain your position:

E. MARKET ASSESSMENT

PREAMBLE

All institutions that develop technology must have in place some mechanism for assessing its market potential. Institutions which assume that their technologies will "sell themselves", without further refinement, are usually disappointed.

Generally agree **Generally disagree**

DEMONSTRATIONS AND MARKETPLACE FEEDBACK

1. Public sector research institutions must build market bridges to the private sector.

17 **Strongly Agree** 25 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

Practical techniques for doing this include:

2. Use of "bench level" scientists and engineers as links to their colleagues in the private sector.

8 **Strongly Agree** 31 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position

3. Use of the technology's inventor as a marketeer to assist in making the necessary industry contacts and in describing the invention and its potential uses.

5 **Strongly Agree** 28 **Agree** 10 **Disagree** 0 **Strongly Disagree**
Please explain your position:

4. Advertising of technologies that are candidates for co-development or licensing.

5 **Strongly Agree** 31 **Agree** 6 **Disagree** 0 **Strongly Disagree**
Please explain your position:

Effective techniques for advertising or marketing technologies include:

5. **"Road shows" at least once per year where the latest technologies are demonstrated with a practical, hands-on approach.**

4 **Strongly Agree** 22 **Agree** 17 **Disagree** 0 **Strongly Disagree**
Please explain your position:

6. Industry-specific seminars to demonstrate technology wares and open the necessary two-way communication between laboratories and the marketplace.

5 **Strongly Agree** 33 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

7. To assist in the generation of market pull, greater emphasis should be placed on bringing technologies close to commercial applicability or at least to a state that makes plausible demonstration-type projects possible.

8 **Strongly Agree** 27 **Agree** 7 **Disagree** 1 **Strongly Disagree**
Please explain your position:

8. Through a combination of internal or external sources, the tech transfer office must gain a thorough understanding of both the technology and its possible commercial application in order to recognize the technology's inherent value in the marketplace.

11 **Strongly Agree** 27 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position:

9. Such an approach can be effective for either the buyer or seller of technology.

9 **Strongly Agree** 32 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

10. An effective tool to assist in determining the market for a technology is to employ business school students to perform a market analysis.

6 **Strongly Agree** 21 **Agree** 12 **Disagree** 3 **Strongly Disagree**
Please explain your position:

11. Business school students with an engineering background are especially effective in this regard.

8 **Strongly Agree** 25 **Agree** 9 **Disagree** 0 **Strongly Disagree**
Please explain your position:

REACHING OUT TO SMALL BUSINESS

12. Small businesses seeking to increase their technology inventory must often take the initiative, especially with private sector labs, and request a laboratory's list of available technologies or ask to license an unadvertised technology that they have reason to suspect exists.

8 **Strongly Agree** 25 **Agree** 9 **Disagree** 0 **Strongly Disagree**
Please explain your position:

13. When public sector research organizations or large private sector organizations attempt to transfer technology to existing small businesses, they must recognize the resource and technology constraints of the small business and work with it to effectively overcome them in order to successfully commercialize the technology.

12 **Strongly Agree** 29 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

14. A particularly effective tech transfer technique is to demonstrate a new product or process and its benefits to potential customers for the technology.

13 **Strongly Agree** 30 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

15. Companies that develop technologies and discover through market analysis that demand is "too small" should consider licensing these technologies to smaller companies geared to be profitable at smaller volumes.

7 **Strongly Agree** 33 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

16. In dealing with local, small businesses, state tech transfer programs are "closer to the customer" than federal programs and hence can provide more effective assistance.

5 **Strongly Agree** 25 **Agree** 9 **Disagree** 2 **Strongly Disagree**
Please explain your position:

17. Small companies desiring new technology should regularly attend federal laboratory meetings such as those sponsored by the Federal Laboratory Consortium (FLC).

2 **Strongly Agree** 18 **Agree** 18 **Disagree** 4 **Strongly Disagree**
Please explain your position:

18. The commercialization plan for a given technology should be organized as a series of stages, with a corresponding staged financial plan.

9 **Strongly Agree** 31 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

19. At each stage the marketplace should be tested to determine a "go"/"no-go" decision for future investment/financing.

4 **Strongly Agree** 38 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

USING NETWORKS TO GAUGE THE MARKETPLACE

20. An effective marketing methodology for public sector research institutions is to develop and participate in public events such as forums, roundtables and workshops, that offer the opportunity for two-way communication with potential users.

7 **Strongly Agree** 30 **Agree** 7 **Disagree** 0 **Strongly Disagree**
Please explain your position:

21. Newsletters or electronic databases of available technology, targeted at companies in a particular technology segment, are an effective vehicle for identifying potential technologies for license.

5 **Strongly Agree** 28 **Agree** 9 **Disagree** 1 **Strongly Disagree**
Please explain your position:

COMPARISONS

22. Public research institutions and laboratories should benchmark their tech transfer projects and marketing methodologies with those of other public research institutions and laboratories on a case by case, worldwide basis.

3 **Strongly Agree** 29 **Agree** 9 **Disagree** 2 **Strongly Disagree**
Please explain your position:

23. To maximize technology transfer potential, universities should closely align their specialty areas (strengths/disciplines) with private sector interests in the surrounding community.

5 **Strongly Agree** 22 **Agree** 13 **Disagree** 3 **Strongly Disagree**
Please explain your position:

INTERMEDIARIES

24. Tech transfer intermediaries who are operationally independent of the laboratory or university should be seriously considered if restraints imposed on tech transfer activities in public institutions hamper the tech transfer process.

10 **Strongly Agree** 23 **Agree** 7 **Disagree** 1 **Strongly Disagree**
Please explain your position:

25. Tech transfer intermediaries can provide an important service to private sector companies by scouting the federal laboratories to identify and screen new technologies.

7 **Strongly Agree** 28 **Agree** 6 **Disagree** 0 **Strongly Disagree**
Please explain your position:

F. RESOURCES

PREAMBLE

Successful technology transfer requires unavoidable up-front commitment of money, people and time. Given that these resources will always be limited, the question becomes, "How do we acquire, maintain, optimize, protect and generally best utilize the resources we know we must have?"

Generally agree **Generally disagree**

CHAMPIONS

1. All inherently risky activities, including technology transfer, require someone to "champion the cause".

26 **Strongly Agree** 15 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

2. The tech transfer project must be able to depend on someone to "drive" the project, "overcome" obstacles,"mediate" disputes,"facilitate" communication,and "bridge" any cultural gap.

20 **Strongly Agree** 21 **Agree** 3 **Disagree** 0 **Strongly Disagree**
Please explain your position:

3. All public sector tech transfer offices must have strong champions at high levels in the administration of the organization -- because payoff is long-term and there will be inevitable pressures to commit the institution's limited resources to meet shorter term goals.

19 **Strongly Agree** 21 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

4. All tech transfer projects should have two project "champions" -- one on the resource or technology push end and one or more at various levels in the recipient firm to facilitate the receipt of the technology and drive the market pull.

18 **Strongly Agree** 22 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

5. Successful transfer of complex, embryonic technology requires an integrated sender/receiver project team.

13 **Strongly Agree** 26 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

6. Champions on both sides must lead and manage, supplying vision, drive and coordination.

16 **Strongly Agree** 23 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

ALLOCATION OF RESOURCES

7. It's important to the success of any tech transfer project that the recipient, no matter how small, be required to commit significant resources either in cash or in-kind.

8 **Strongly Agree** 31 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position:

8. Successful transfer of a given technology, require that the technical people involved dedicate a significant fraction of their time (20%?) to the transfer process itself.

4 **Strongly Agree** 25 **Agree** 11 **Disagree** 1 **Strongly Disagree**
Please explain your position:

9. To be effective in marketing technology, in a world that demands a customer oriented approach, university and federal lab tech transfer offices must employ full-time staff, preferably with outside industrial experience.

12 **Strongly Agree** 28 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

10. Expertly crafted patents are critical to the longer term protection of a new technology.

12 **Strongly Agree** 19 **Agree** 10 **Disagree** 0 **Strongly Disagree**
Please explain your position:

11. It is important that the tech transfer office have the resources to fund the often expensive, up-front investment in a "solid" patent, including the increasingly critical international protection.

10 **Strongly Agree** 26 **Agree** 7 **Disagree** 0 **Strongly Disagree**
Please explain your position:

IMPORTANCE OF THE LONG-TERM VIEW

12. A new tech transfer office should be treated like any high risk start-up venture.

6 **Strongly Agree** 23 **Agree** 12 **Disagree** 0 **Strongly Disagree**
Please explain your position:

13. It should be viewed as a long-term investment with adequate capitalization and not be expected to produce short-term positive cash flow.

11 **Strongly Agree** 32 **Agree** 0 **Disagree** 0 **Strongly Disagree**
Please explain your position:

14. Because of the lag time between the licensing of intellectual property and the receipt of royalties, universities must be prepared to provide an appropriate, consistent level of resources to offset the overhead cost of their tech transfer offices, which may not turn "profitable" for months or even years.

11 **Strongly Agree** 31 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

15.Tech transfer managers, like managers everywhere, must make time for strategic longer term planning and avoid being consumed by short-term "fire fighting".

11 **Strongly Agree** 30 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position :

16. This is impossible if the institution does not commit a minimum threshold of resources.

10 **Strongly Agree** 30 **Agree** 2 **Disagree** 1 **Strongly Disagree**
Please explain your position:

17. Political leaders must be convinced that adequate public sector support of basic research is critical in providing the pool of ideas which subsequent joint public/private sector funding can convert into drivers of economic development.

11 **Strongly Agree** 29 **Agree** 2 **Disagree** 1 **Strongly Disagree**
Please explain your position:

G. REWARD/RECOGNITION

PREAMBLE

A tech transfer project or organization, like any well managed project or organization in any field, must have a well thought out reward system that drives the desired organizational behavior, builds a team approach and fairly recognizes the contributions from all members of the team.

Generally agree **Generally disagree**

REWARD/RECOGNITION: SYSTEMS AND POLICIES FOR THE PUBLIC SECTOR

1. A research institution committed to technology transfer must develop a structured methodology to measure the degree of participation by its personnel in tech transfer and a system to reward participation in the process.

11 **Strongly Agree** 28 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position :

Public sector research institutions should reward their faculty/researchers by:

2. Allowing them to take an equity position in existing companies that market or utilize their inventions.

5 **Strongly Agree** 27 **Agree** 10 **Disagree** 1 **Strongly Disagree**
Please explain your position:

3. Allowing them to become shareholders in new companies formed to exploit their inventions.

3 **Strongly Agree** 29 **Agree** 8 **Disagree** 0 **Strongly Disagree**
Please explain your position:

4. Academic researchers must be encouraged not to bypass the university and its tech transfer office.

13 **Strongly Agree** 24 **Agree** 5 **Disagree** 0 **Strongly Disagree**
Please explain your position:

5. Rather than relying on penalties alone, the most effective way to do this is to provide exceptional and critical value-added services through the tech transfer office such that the faculty inventor is better off using the office than attempting to bypass it.

15 **Strongly Agree** 26 **Agree** 2 **Disagree** 0 **Strongly Disagree**
Please explain your position:

6. The university, as a matter of policy, should be generous in the percentage of royalties or other revenues returned to the inventor, either personally, or to support the inventor's research (at least 50%?), thereby encouraging the inventor to work through the tech transfer office.

8 **Strongly Agree** 30 **Agree** 4 **Disagree** 0 **Strongly Disagree**
Please explain your position:

7. Academic institutions need policies and mechanisms in place that promote the involvement of faculty members in transforming technology to a state more closely aligned with the needs of the marketplace.

7 **Strongly Agree** 29 **Agree** 7 **Disagree** 0 **Strongly Disagree**
Please explain your position:

The reward and recognition system should be strong enough so that:

8. Faculty members are recognized for foregoing some individual research so as to put a portion of their energies into furthering the tech transfer mission of the university.

4 **Strongly Agree** 30 **Agree** 6 **Disagree** 2 **Strongly Disagree**
Please explain your position:

9. Faculty members are encouraged by university policies to spend a significant portion of their work-week on tech transfer activities.

1 **Strongly Agree** 18 **Agree** 18 **Disagree** 4 **Strongly Disagree**
Please explain your position:

10. The tech transfer office should position itself to minimize potential conflict between the research and technology transfer mission of the university.

9 **Strongly Agree** 33 **Agree** 1 **Disagree** 0 **Strongly Disagree**
Please explain your position:

Some mechanisms for minimizing the potential conflict include :

11. Offering the resources of the tech transfer office to obtain support for faculty members' research.

4 Strongly Agree 28 Agree 6 Disagree 0 Strongly Disagree
Please explain your position:

12. Adopting policies and procedures that minimize any disruptions to a faculty members' research.

6 Strongly Agree 36 Agree 0 Disagree 0 Strongly Disagree
Please explain your position:

13. Asking department heads and deans to recognize and reward faculty members who work with the tech transfer office.

6 Strongly Agree 33 Agree 3 Disagree 0 Strongly Disagree
Please explain your position:

REWARD/RECOGNITION: EXPECTATIONS

14. Those wishing to access public sector research institutions must realize that technology transfer is not the primary job of most research directors.

9 Strongly Agree 30 Agree 2 Disagree 0 Strongly Disagree
Please explain your position:

15. Therefore most public sector research/lab directors may not share the same commercial expectations.

9 Strongly Agree 30 Agree 3 Disagree 0 Strongly Disagree
Please explain your position:

16. The greatest reward for public sector laboratories and their supporting staff is more often increased public visibility of the laboratory and its activities then it is institutional or personal monetary gain.

4 Strongly Agree 31 Agree 9 Disagree 0 Strongly Disagree
Please explain your position:

17. Internal sharing of technology assets is a strategic imperative. The institutions reward and recognition system must encourage this behavior.

6 Strongly Agree 34 Agree 2 Disagree 0 Strongly Disagree
Please explain your position:

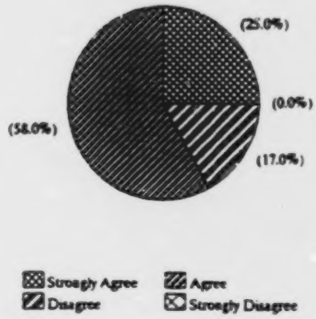
Any last thoughts? For example:

Are there any "Best Practices" that you would like to add? What would you add to the survey to make it more comprehensive? What do you feel is the weakest/strongest core practice and why? How would you proceed in further defining "Best Practices"?

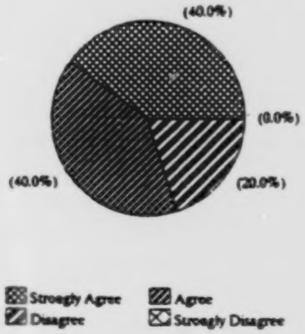
IV. SELECTED RESPONSES WITH CHARTS and COMMENTS

B: 1. Survey results suggest that the management in both federal labs and, to a lesser extent, universities still view their tech transfer activities primarily in terms of enhanced public image rather than in terms of economic benefit and rewards to their institutions, their people and the community. For long term success, tech transfer must be integrated into an economically driven strategic plan and not treated as a public relations veneer.

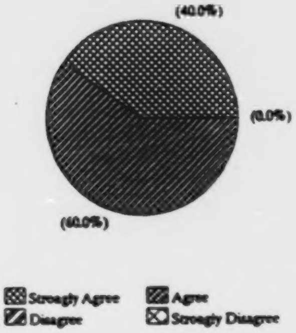
Universities



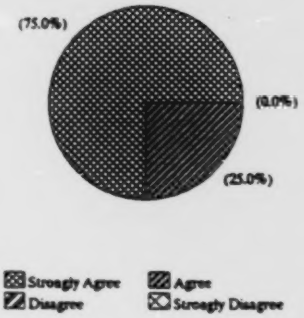
Federal Laboratories



Small Companies



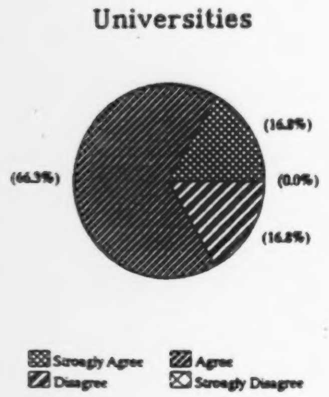
Large Companies

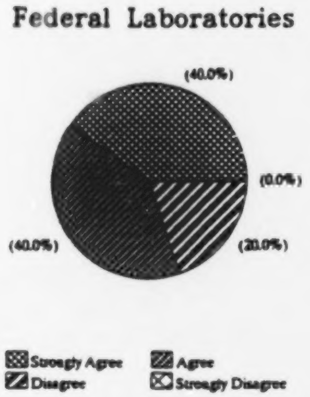


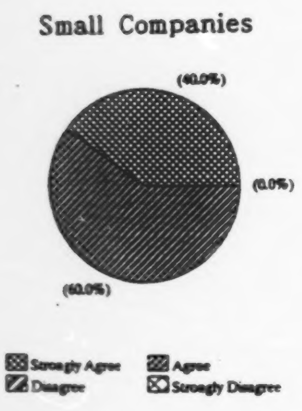
There was very little disagreement with this statement. A positive point that was revealed by the statement is that no institution appears to be participating in tech transfer strictly for the "public relations" aspect. Public sector institutions feel that tech transfer activities should provide a spin-off benefit of positive public relations which in turn they may utilize as leverage when they request funding for their operations. Further, it is clear that private sector organizations participate in tech transfer activities primarily for reasons of economic gain or benefit.

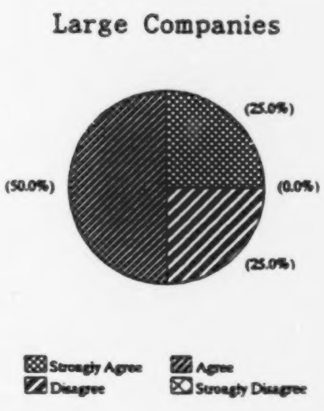
2. As part of its tech transfer strategic plan, every institution must formulate a consistent set of guidelines and a decision-making methodology to deal with such issues as:

What, where and when to patent
What activities to pursue "in-house" and which to "farm out"
When to seek royalties and when to seek equity


Universities


Federal Laboratories

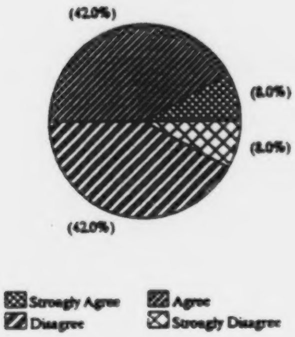

Small Companies


Large Companies

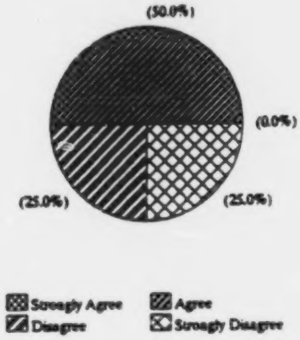
An overwhelming majority of the respondents agreed with this proposal, however in some instances it was a "tempered" agreement. The fear seemed to be centered around the phrase "decision-making methodology." the respondents were concerned about the rigidness of such a methodology and its potential to limit flexibility within a tech transfer event. A representative response was, "Guidelines maybe, but too much rigidity causes too much time to be spent fitting circumstances to the mold."

3. A new tech transfer office, in particular, with limited resources, should carefully consider utilizing private sector brokers to evaluate invention disclosures, obtain patents when appropriate, find licensees and negotiate licenses.

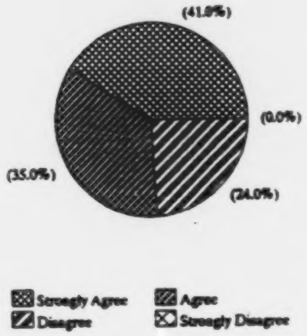
Universities



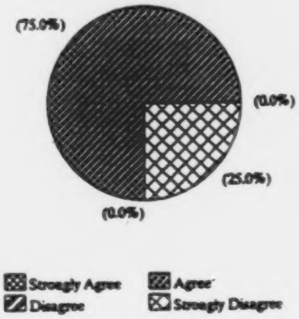
Federal Laboratories



Intermediaries

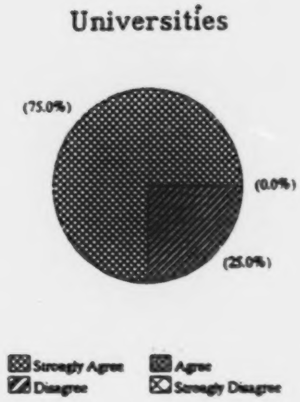


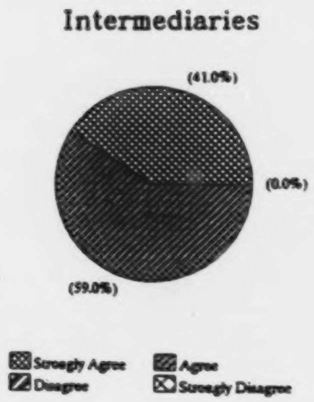
Large Companies



This statement evoked very strong and a very wide range of responses. Brokers/intermediaries, many of whom were part of our respondent pool, agreed or strongly agreed that their services should be utilized by new tech transfer offices. However, outside of this category of respondents, there is at least 50% disagreement about the policy of new tech transfer offices utilizing brokers. A combination of responses state the general feeling: "Depends on amount of 'technology' available to transfer. There is a level at which every organization should have its own internal effort." "If the T2 office is going to contract out work like this, then it is really not a T2 office, rather it is a disbursement/contracting office."

5. To attain consistent tech transfer project success, university tech transfer offices must find and retain experienced staff, engage in intermediate- and long-term planning and continually evaluate their output of services.



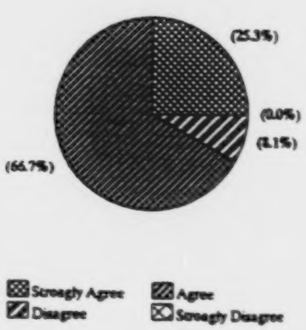


Universities generally have strong agreement that their tech transfer offices must engage in significant planning, hire the most qualified individuals to represent their interest in tech transfer endeavors, and continuously evaluate "how well the tech transfer office is serving its customer." One respondent summed it up by stating, "finding and retaining staff is paramount to success. Evaluating service provided and satisfaction of the clients served...is equally important."

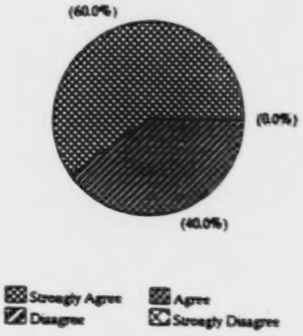
An important side note is contained in the table below. Notice how the universities with less than five years in tech transfer activities contrast with those universities with greater than 20 years in tech transfer activities.

8. There is no fixed formula for tech transfer success. Each tech transfer project must be treated flexibly in the environment in which it occurs.

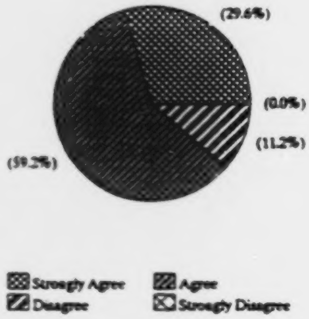
Universities



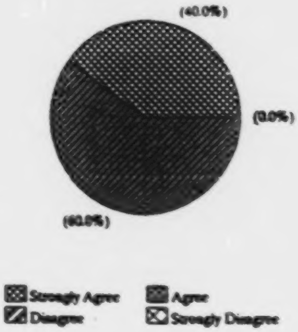
Federal Laboratories



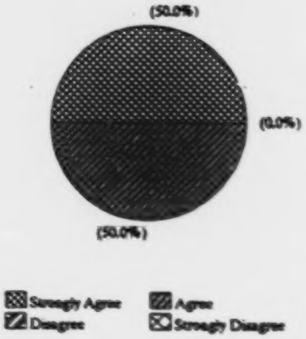
Intermediaries



Small Companies



Large Companies

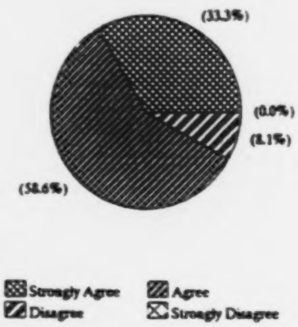


With two noted exceptions, both describing themselves as intermediaries, there is universal agreement about the lack of a fixed formula for tech transfer success. In those organizations that did choose to disagree, it should be noted that both claim to participate in "less than three tech transfer projects" and the scale of the tech transfer projects is "less than 1,000 man-hours." A commentary of disagreement was, "There are certain key steps that apply in all cases. (Strengthen the program in all cases.)"

The respondents stressed the need to be flexible in the approach, and within each stage of the tech transfer event. Most respondents made statements such as: "I feel there needs to be some guiding principles and then the (tech transfer) office can be flexible within those guidelines."

9. All organizations involved in tech transfer projects should adopt a combined technology push/market pull approach for the best chance of success.

Universities



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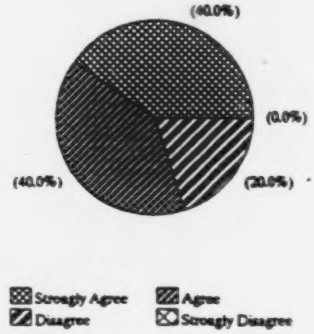

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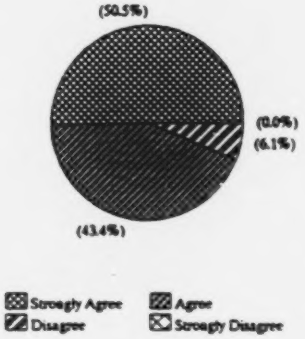

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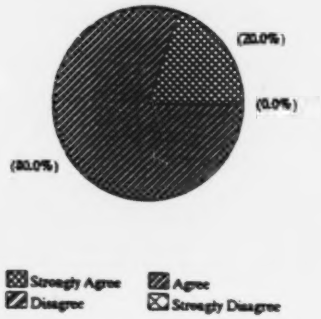

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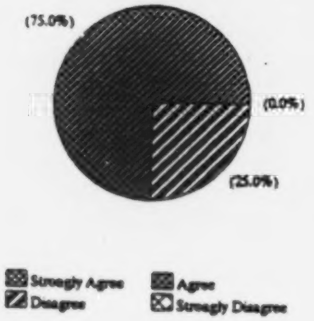
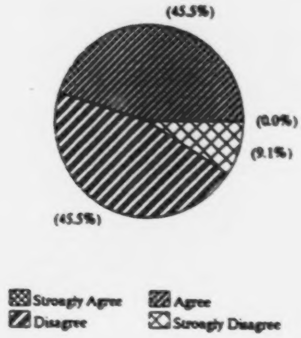


Private sector companies both large and small did not strongly agree with the technology push/market pull approach. However, there was broad general agreement among all the respondents that this is a preferred approach. The most prevalent concern about this approach is balancing the benefit of having market pull with the need to commercialize a technology for which a market may not yet exist. This argument is reinforced by statements such as "there is a tendency to focus on technology push, which can be out of touch with reality."

12. Most institutions require their faculty/staff to assign all inventions to the institution as a condition of employment. Academic institutions should consider granting inventors the option of retaining title to their invention so they remain free to commercialize it themselves. A well-formulated tech transfer program would then be one which had the capability to add so much value that most inventors would gladly go through the tech transfer office and assign their rights to the university.

Universities



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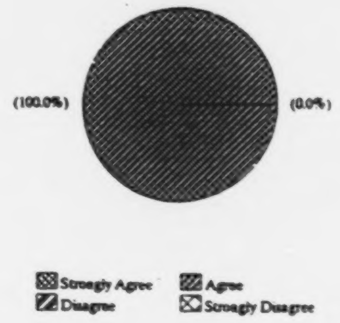

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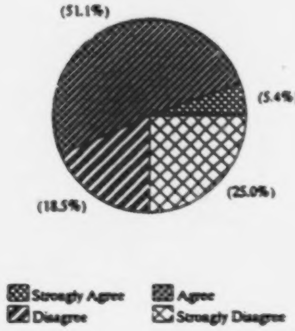
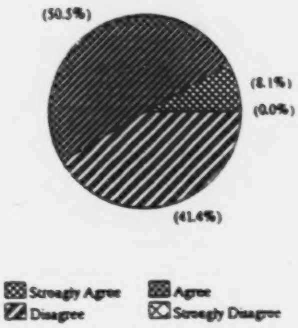


With the exception of one intermediary, no public sector respondent strongly agreed with this statement. However, it should also be noted that four (4) intermediaries strongly disagreed with this statement. There is also major division about whether a university should or should not allow inventors to retain the title to their invention and be permitted to commercialize it themselves. The disagree comments were numerous and strong as the two following examples demonstrate. "Only a small percentage of university inventions have much commercial potential. Those would be the ones whose inventors would choose to retain title." "Impractical! This sounds like the institution would have a lot of expenses and no reward guaranteed. A better solution would be more equitable royalty-sharing between the inventor and the institution." On the side of agreement there were comments such as: "Many institutions do grant 'conditional' rights to inventors when the university lacks resources. The 'conditions' can become problematic. The latter statement I do agree with, but must include creative attraction of resources."

13. When a university perceives that it has made a "landmark" discovery, it should not only engage in licensing but also take an equity interest in the licensee.

Universities



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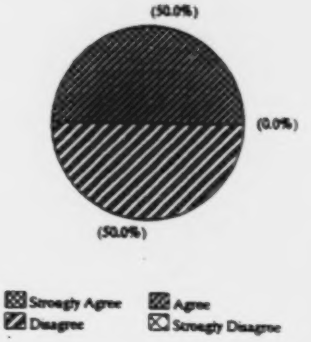

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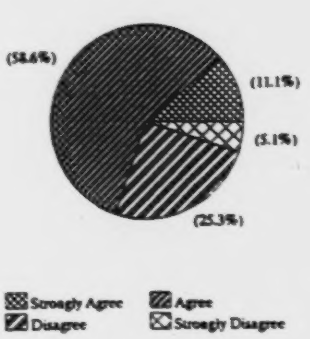
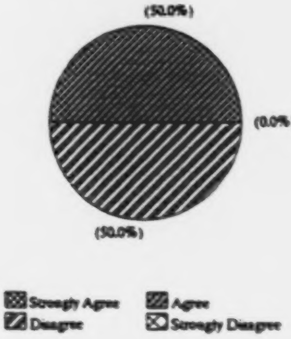
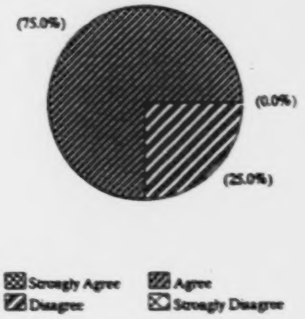


Small Companies



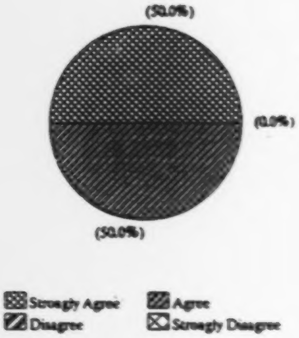
Large Companies



Among all respondents, a slightly larger portion chose to agree with this statement. The issue of whether or not to take an equity position, even if it involves a "landmark" discovery is far from being unanimous in either the public or private sector. Many respondents cautioned that an equity position may not be permissible due to university policy or perhaps the most qualified licensee for commercialization will not permit the university to obtain an equity position. One respondent who disagreed stated that an equity position is appropriate "only if the technology warrants a start-up situation." Representative agree comments included" "Equity should be considered for every invention licensed in which it is available." and "Evidence suggests that equity is the way to build wealth."

14. It is the responsibility of the tech transfer office to fully ascertain and disclose whether there are any impediments to the licensing of technology. For example, it is important to clearly establish whether an institution has "clear title" to a specific technology.

Universities



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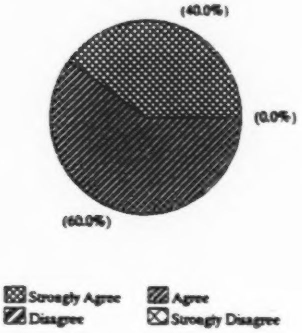

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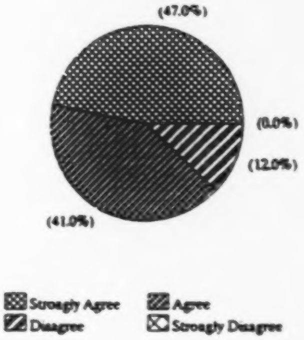

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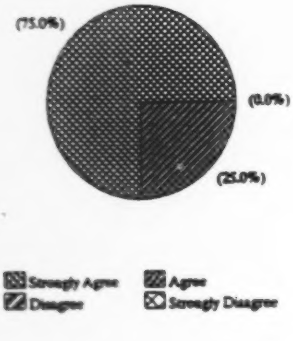

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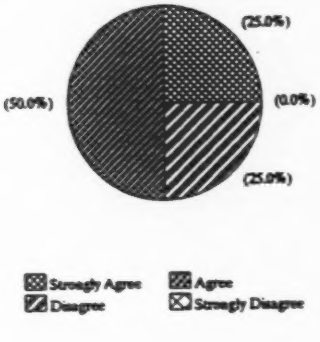
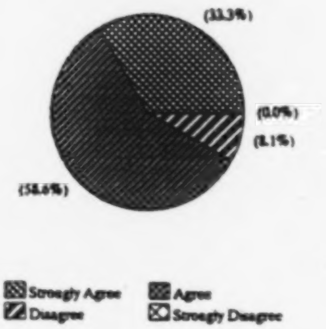


Those organizations who are a significant "source of technology" clearly understand and are in favor of the premise of "clear title" to technology. It is also clear that small companies may not have the resources to make a determination that they have "clear title" when they acquire a technology and are largely dependent on the licensing entity or tech transfer office to provide them a technology without "hooks." However, to protect licensees, there is some built-in protection. As one respondent pointed out, "A license usually contains a warranty by the licensor that they have the 'title' and are able to grant a license."

15. Long-term research is an important component to the overall tech transfer program strategy because it brings dollars into the program/university and creates a pool of new ideas available to industry.

Universities



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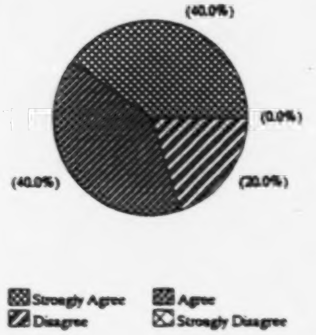

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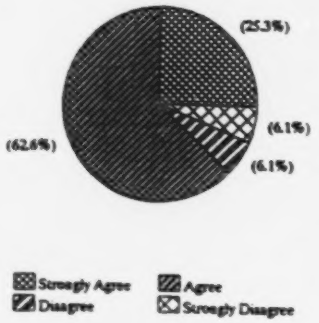

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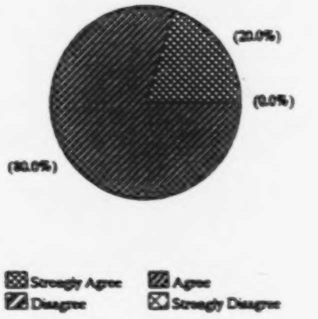

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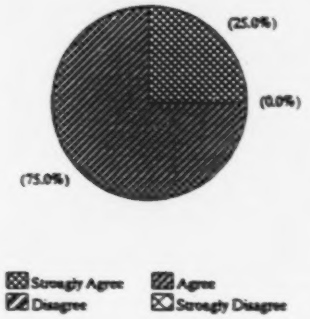
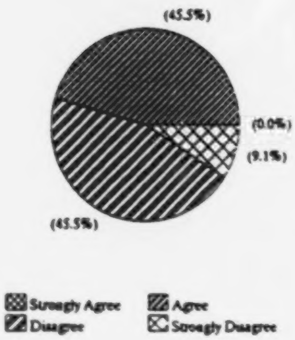


There is general agreement among all respondents that resources have to be allocated that promote a long-term research position in order for tech transfer to also exist as a long-term entity. Predictable, university respondents tended to value long-term research somewhat more than other types of respondents. Even among respondents who chose to disagree, there was a positive position taken toward long-term research. For example, one respondent stated: "Long-term research is not an objective of the tech transfer program but rather of the institution...first comes the research, then the tech transfer program."

20. For example: A tech transfer organization should center itself around Total Quality Management concepts and develop specific mechanisms such as evaluations and certifications in order to implement its strategic plan.

Universities



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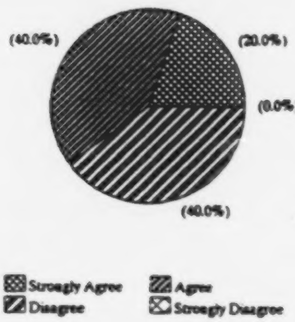

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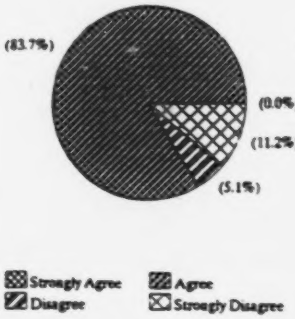

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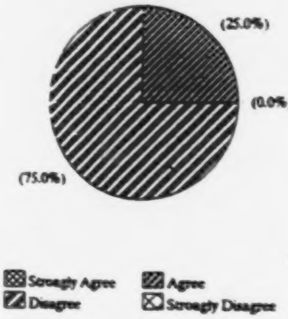
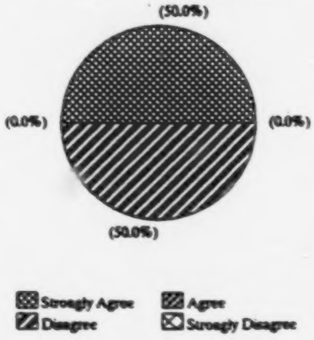


Large Companies

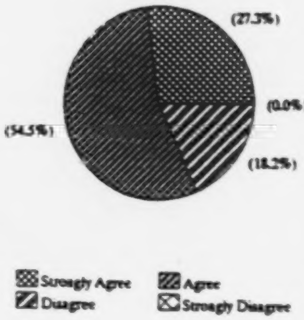


The feeling of our respondents is that an organization such as a tech transfer office should have mechanisms in place to evaluate the broad performance of the office as well as the particular service products it may offer. however, many respondents also felt that attempting to apply one management philosophy such as Total Quality Management is a mistake. Where TQM has been wholeheartedly embraced and is solidly interwoven into an organization's culture and philosophy, perhaps the TQM approach to managing a tech transfer organization is the best/only choice. Other tech transfer organizations may benefit by viewing TQM as an important "tool kit" whereby individual ideas, approaches, etc. may be applied as the organizational environment dictates.

The typical sentiment of the responses were reflected in statements such as, "Forget about management fads; simply use good established management practices that are adaptable to different situations."

21. Public sector institutions that participate in applied research and provide technical assistance should utilize, where appropriate, private sector business practices such as TQM, cross-functional teams and continuous improvement methodologies.

Universities



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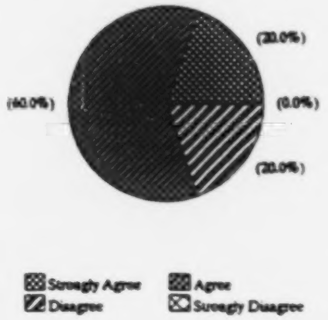

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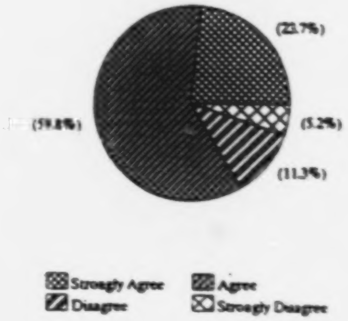

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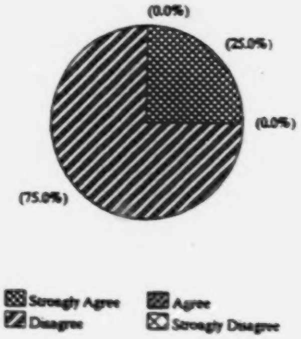

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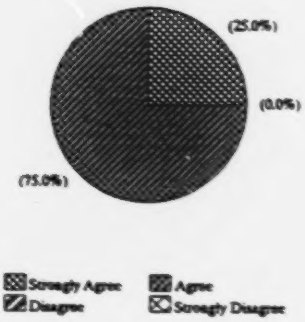
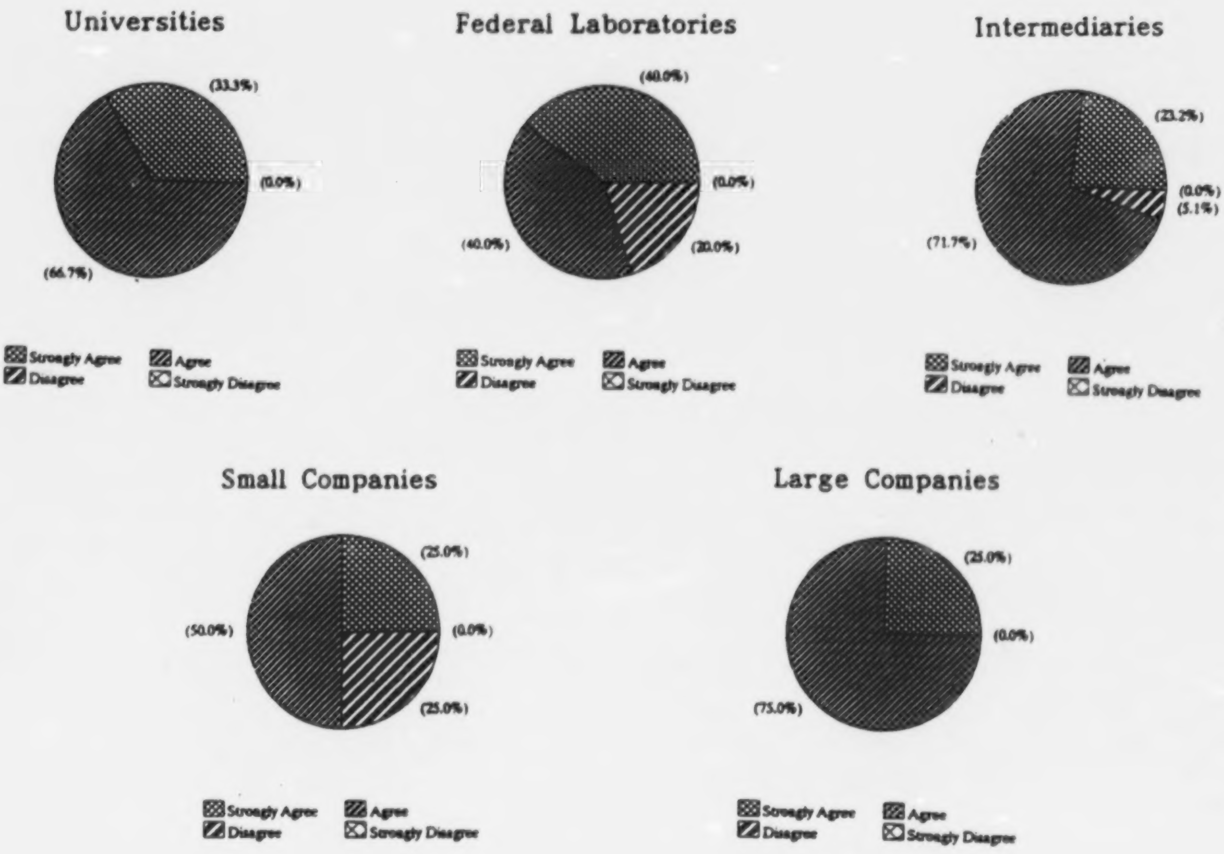


Although there is some broad disagreement, particularly among small companies with this statement, the general belief among all other categories of respondents is that it is appropriate to choose, test and evaluate the application of private sector business practices in public sector organizations. Again, the key is to discover and exploit what works! One respondent commented that it's important for a public sector organization "...to try to integrate such practices in its operations."

22. Public and private sector tech transfer offices should integrate systematic intermediate- and long-term planning and evaluation mechanisms into their operations.

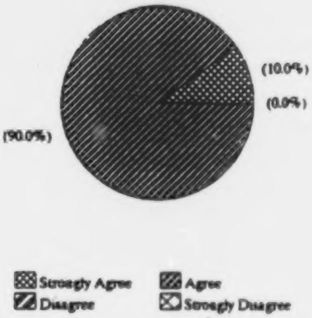


There is very little disagreement with this statement among all categories of respondents. Most of the concern was centered around performing planning as an end in itself and not as a means to a predetermined goal. Typical of the respondent commentary was this statement: "Planning helps to achieve goals. Your focus on planning is misplaced. The key step is to set goals and refine into objectives. Then and only then, do any planning."

Note: This respondent may have felt that we (the surveyors) valued planning for sake of itself and not as a tool to achieve goals. Perhaps the question was inappropriately worded, this is not our belief.

23. Benchmarking of the highest priority activities against other institutions' corresponding key tech transfer processes should be done on a long-term basis.

Universities



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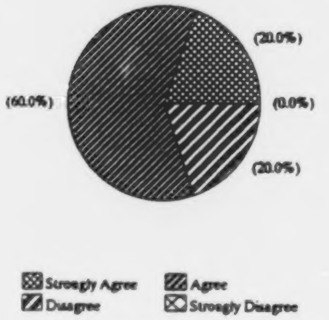

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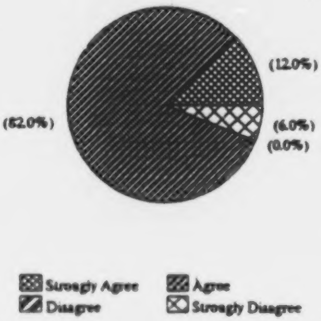
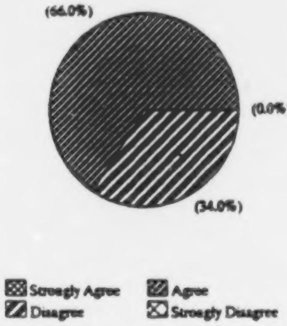
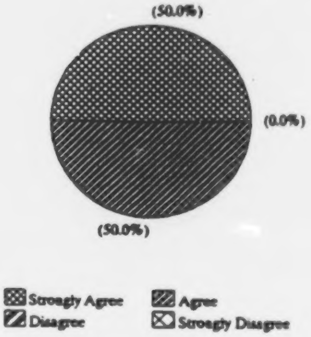


Small Companies



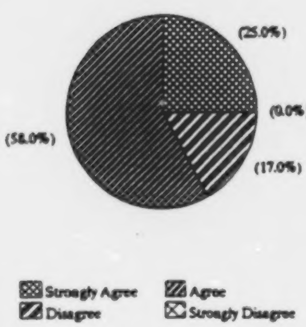
Large Companies



There is qualified agreement, not overwhelmingly strong of the appropriateness of benchmarking priority tech transfer processes against other institutions' processes. The area of concern stems from the multitude of environments in which a tech transfer project may take place. Different environments require different tech transfer processes be applied. One respondent was very concerned about the potential for "apples-oranges comparisons." Small businesses appeared somewhat uncomfortable with the benchmarking approach due to the fact that it is both an ongoing and resource intensive process.

26. As tech transfer emerges as a well-structured discipline, more specific tools are becoming available. To be successful, the tech transfer office must actively seek out and deploy such tools.

Universities



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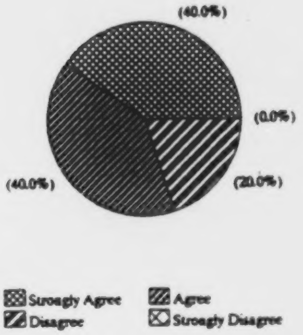

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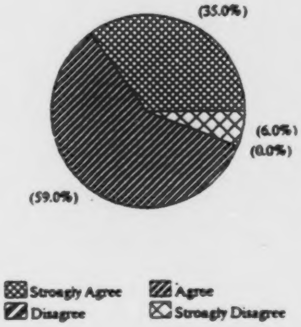
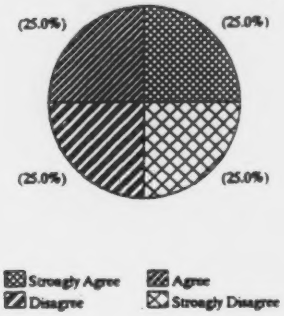
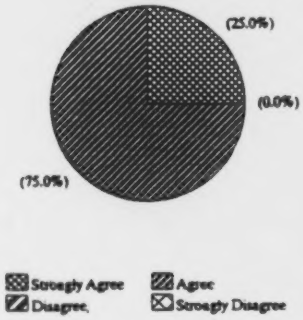


Small Companies



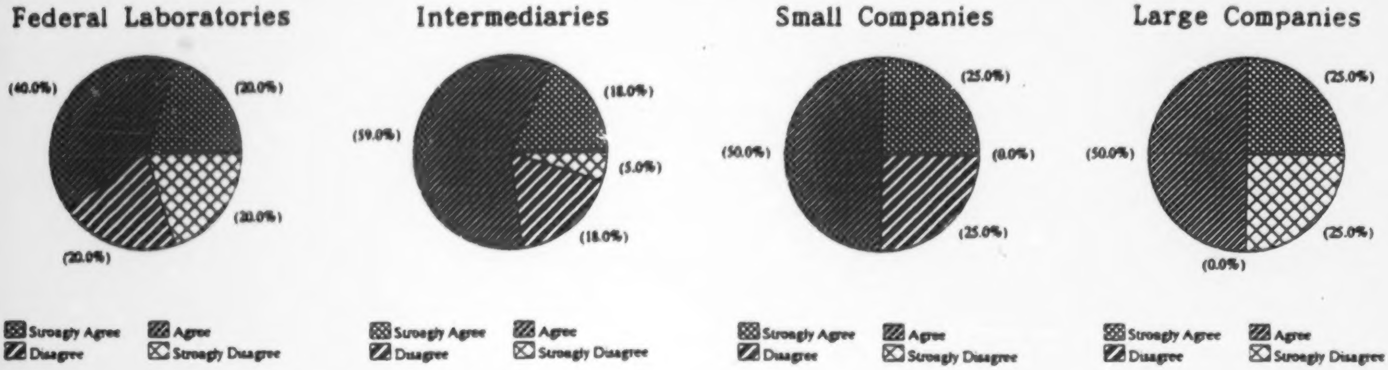
Large Companies



Although there was general agreement with this statement, two points of contention were repeatedly raised by our respondents. First was the concern as to whether tech transfer is truly "emerging as a well-structured discipline." The second was the issue of what constitutes a "tool" and what benefits would be expected to accrue from its use. The commentary was varied but a comment that can be considered as representative is as follows: "But the development of transfer problems will always outpace our knowledge - we'll never...get a well-structured approach...Thank God!"

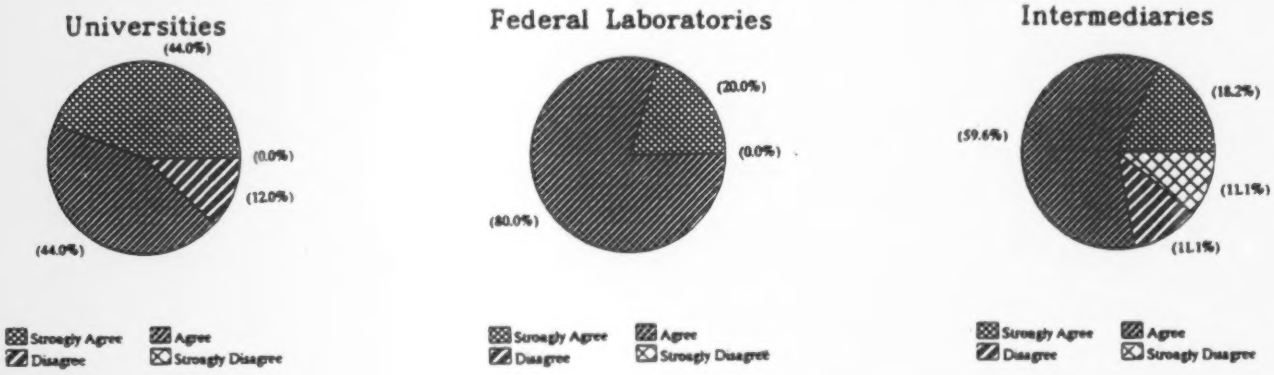
For example:

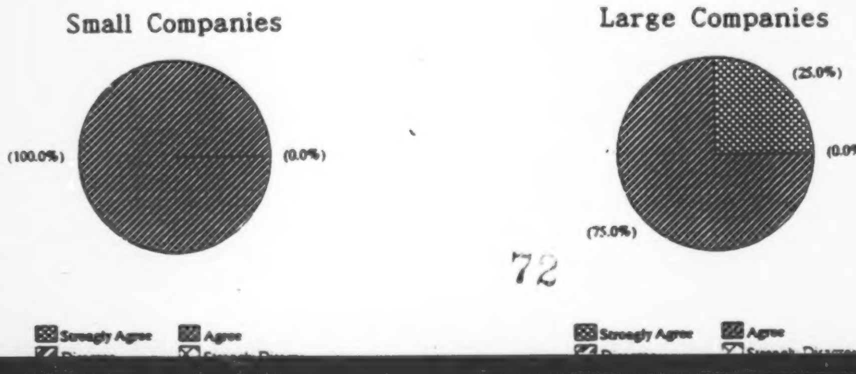
a) the standardized Cooperative Research and Development Agreement (CRADA) now widely used to define federal lab/private sector interactions



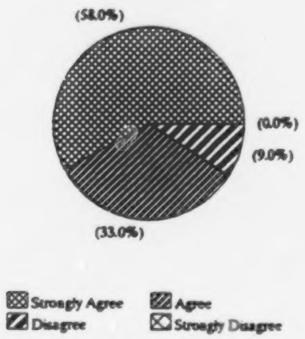
It is clear from our respondents that there is a reasonable level of support for the concept of the CRADA, however many were sharply critical of the details of the process. Even within the "Federal Laboratory" category, there were wide and varying degrees of agreement and disagreement. Some of the commentary on CRADA's was quite sharp but offered little constructive value. In almost all of our categories of respondents, as many strongly agreed as strongly disagreed. Among the constructive commentary were statements such as: "We are using CRADA's as a stepping stone for continued interaction (with the lab)...", "A model CRADA is a starting point, but usually must be modified to satisfy individual requirements/biases/policies, etc." and "Standard contracts help get things started, but we walk away if the lab says 'no' to changes to CRADA's."

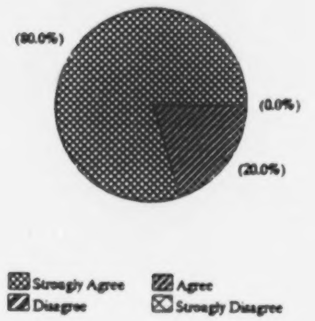
b) a number of online databases which feature available technology and technologists

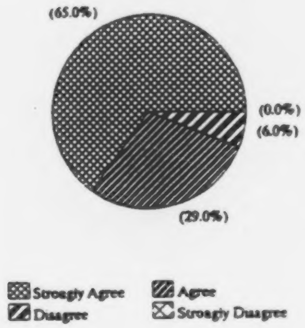


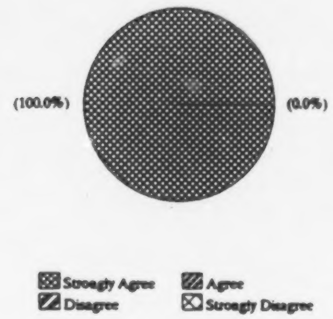


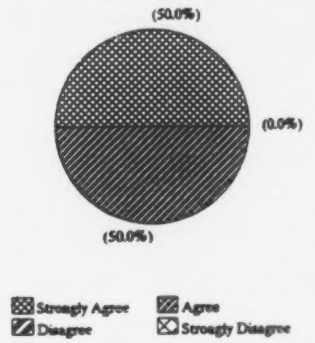
27. In most, if not all, tech transfer projects, project success depends on the development of strong partnerships, both internal and external where trust, respect and communication form the bond.


Universities


Federal Laboratories


Intermediaries


Small Companies

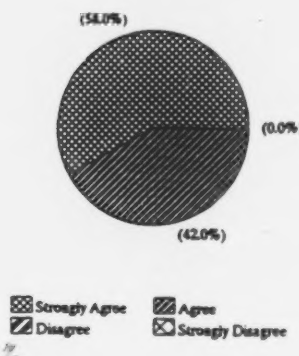

Large Companies

All but two of the respondents gave an affirmative response, however it also become very clear that in a specific tech transfer event where a relationship between source and recipient may be intense, relatively short term, occur at multiple organization levels and involve technology that is complex in nature, nouns such as trust, respect and communication take on special emphasis. Two representative responses were, "Essential!" and "If there is trust on 'both sides' then all will go well."

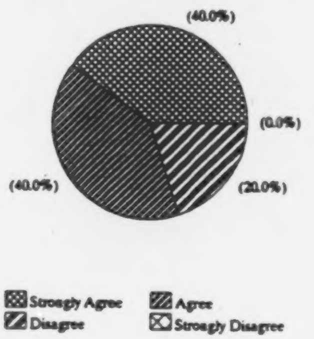
However, a respondent that did disagree made this important contribution: "Trust, respect and communication may be necessary, but they are not sufficient. A shrewd economic interest is required."

28. No company today, no matter how large, can generate internally all the new technology it needs to be competitive. It must seek out scientific insight worldwide and be willing to provide funding and other resources to leading researchers and scientists around the world.

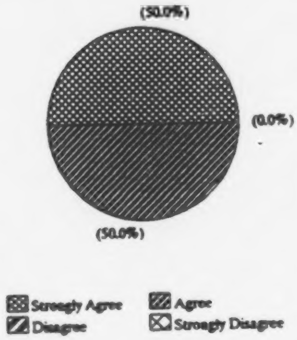
Universities



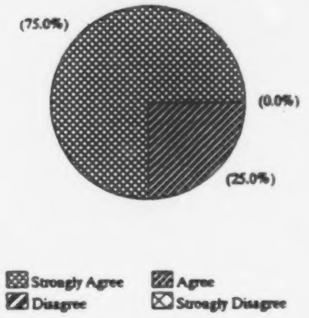
Federal Laboratories



Small Companies



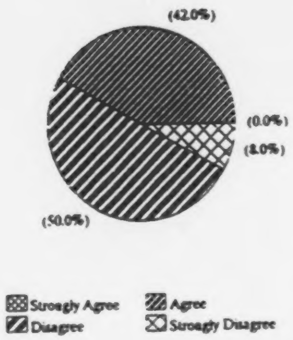
Large Companies



It appears that American business is rapidly reaching an understanding of the need to seek out potential sources of technology on a global basis. All but one of the respondents agreed with the need to "think globally" when allocating resources that may lead to tomorrows' technologies. However, in many cases, agreement was followed by some words of caution such as: "We are in global competitiveness - however, just funding everyone wherever they are in the world is not a panacea." - i.e. judgement and selectivity are needed, perhaps more than ever.

31. A small organization with limited resources should consider participation in a number of smaller tech transfer projects rather than a single large one.

Universities



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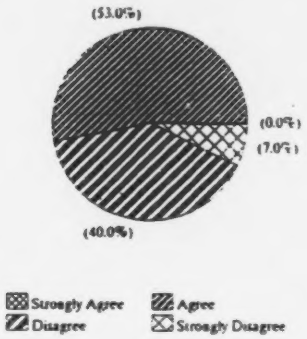
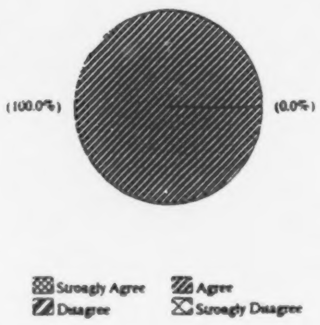
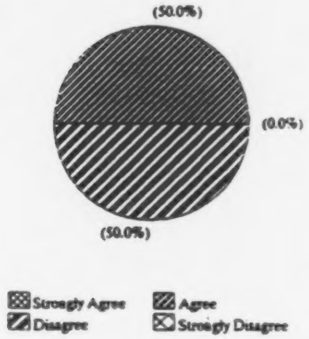


Federal Laboratories



Small Companies



With the exception of federal laboratories, all respondent categories were quite divided about the strategic orientation for a small organization. Since federal laboratories have a "large project" orientation, they should be recognized for their open-minded response where they recommend that small organizations "participate in a number of smaller tech transfer projects." Commentary covered the full spectrum from "The more the deals, the better" to "...but don't spread (resources) too thinly."

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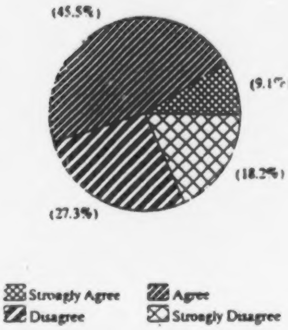
33. An effective means to commercialize university-generated technology is through the formation of a holding company which can identify R&D with commercial potential and initiate new companies, as appropriate.

Universities



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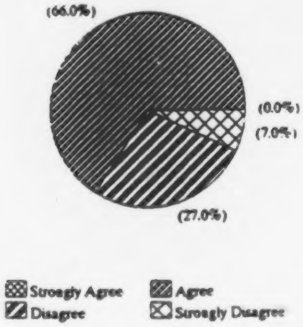
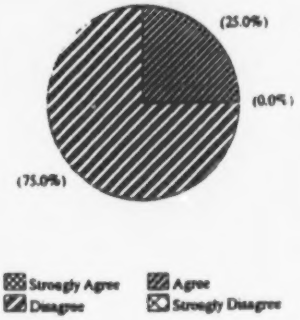
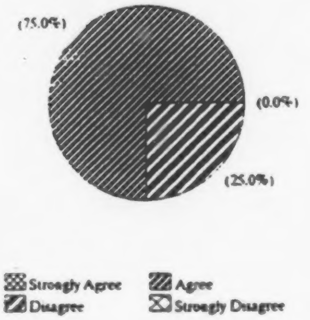


Small Companies

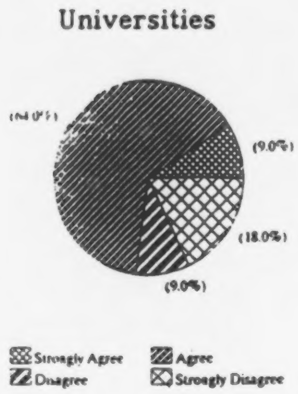


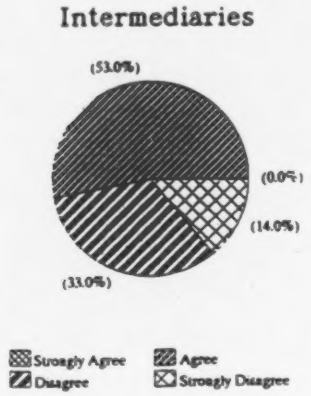
Large Companies

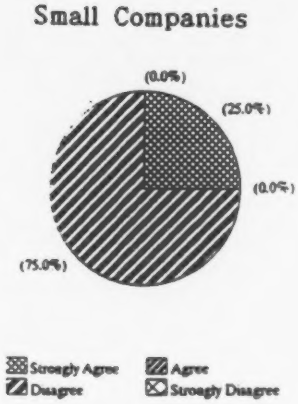


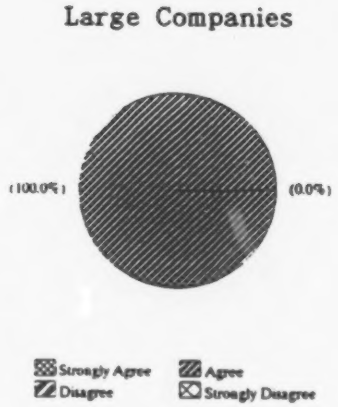
Universities are split as to whether the holding company approach is the best approach for evaluating and promoting university-generated technologies. Large, private sector companies feel more comfortable with the holding company approach. Perhaps this is due to the structuring of many large organizations that utilize such concepts as profit centers, business units and portfolio management. There is also strong feelings that if the holding company approach is utilized, it should be owned and operated by private sector parties. Representative commentary in this area included, "Strongly disagree that university should own a holding company. It should be private" and "Best done by entity other than the university itself."

34. As a matter of policy, these holding companies should provide support and practical assistance to their offspring for as long as required.









Universities and large companies are somewhat more benevolent toward new startups and spinoffs than the other categories of respondents. It was rather surprising that 75% of the small company respondents chose to disagree with this statement. By far, the most concern with this statement was with the phrase "...for as long as required." Commentary addressing this included: "'As long as required' may mean many years and many dollars thrown away" "the length of support should be defined in the agreement" and" to be credible, must kill projects if fail to meet reasonable criteria."

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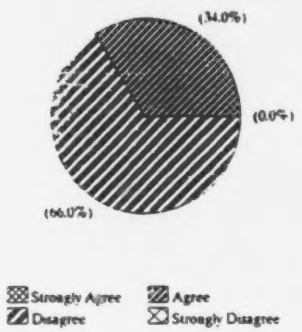
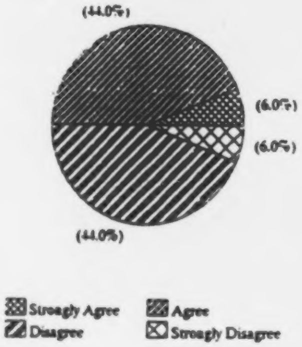
41. It is good general strategy and sometimes particularly economically attractive for a company specializing in a given technology to locate in proximity to public research institutions or laboratories that share the same areas of interest and expertise.

42. For example, some federal laboratories offer more favorable licensing terms to firms willing to relocate nearby.

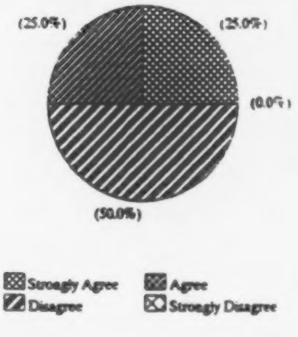
Federal Laboratories



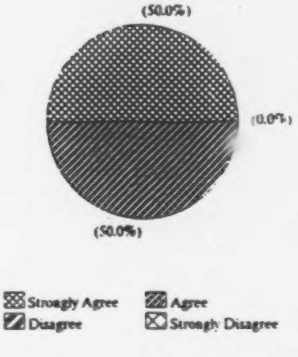
Intermediaries



Small Companies



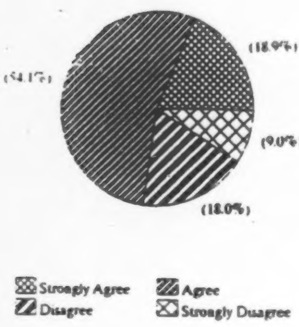
Large Companies



There is broad general agreement on the value of close proximity for organizations to locate near targeted technology sources. However, special or preferred treatment and/or incentives from public sector sources of technology, especially at the federal level, draws a significant amount of fire. The respondents noted potential concerns with commentary such as: "This may not be in accord with federal 'fairness of opportunity' rules" and "It's inconceivable to me that LLNL could grant favorable treatment to only those companies willing to relocate to California or LANL to New Mexico." One possible alternative may be for small, local companies to seek out monetary and other resources available through state or local economic development agencies.

44. Universities should consider establishing research parks as a means to attract private sector operations that enhance university research programs and create local economic development.

Universities



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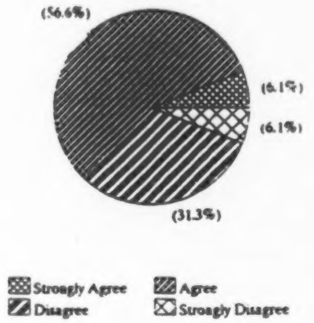
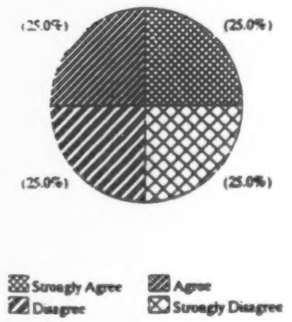
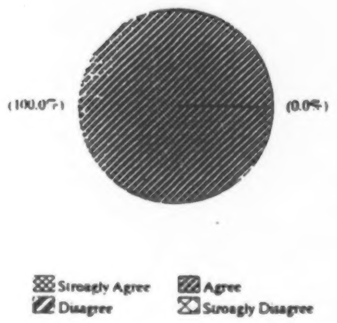


Small Companies



Large Companies



Large companies are comfortable with the research park approach for universities and a large portion of the university respondents felt comfortable with this approach as well. Intermediaries, as a group, expressed a significant amount of disagreement. All categories of respondents provided a large amount of commentary that covered a wide range of perspectives. Some representative examples are: "Only if this is a element of serious economic development strategy...rather than just a real estate exercise. Value adding by the university should be the key" "Research parks are too expensive for the small entrepreneurial company" and "It's not certain that investment in real estate is the key just because it worked at Stanford. Others have failed."

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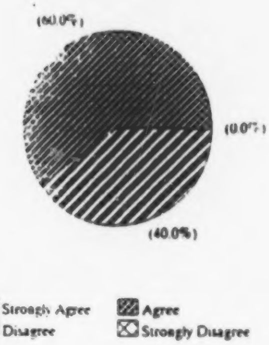
45. Statewide public sector tech transfer offices should place a personal representative permanently inside nearby federal laboratories to assist with tech transfer from within the laboratory aimed at local economic development.

Federal Laboratories



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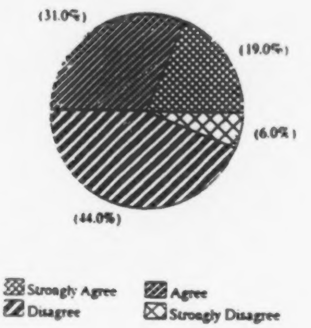

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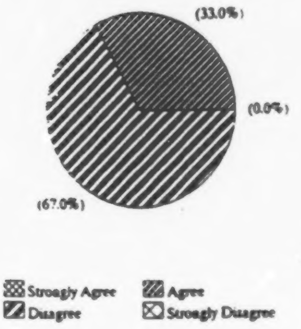
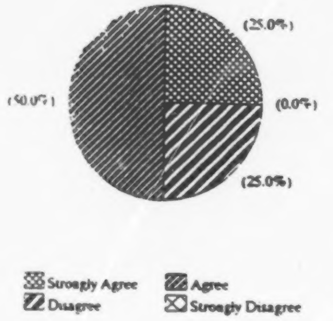
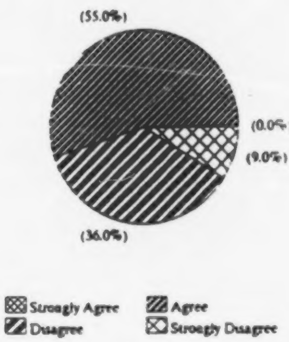


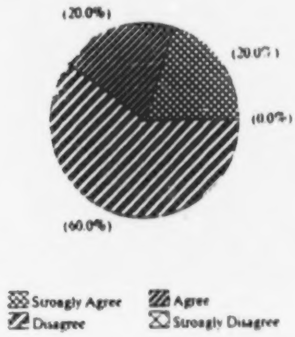
Large Companies

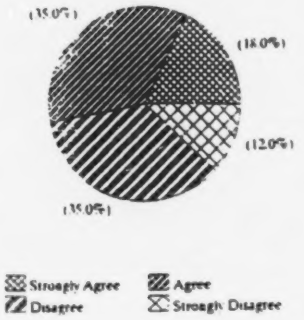


It was somewhat of a surprise to see 60% of the federal laboratory respondents agree with this statement. Even among those respondents who chose to disagree, many found the end result (economic development) desirable but expressed some concerns about the means. Some specific concerns as expressed by the commentary are: "Have liaison people, but no need to 'place' at laboratories" "Good idea! But be careful of personnel selected. (Must be highly qualified)" and "permanently sounds too bureaucratic' should be evaluated as time goes on."

48. In order to play an effective role, a tech transfer intermediary should limit the range of technical areas in which it is active to those fields in which it has in-house technical expertise.


Universities


Federal Laboratories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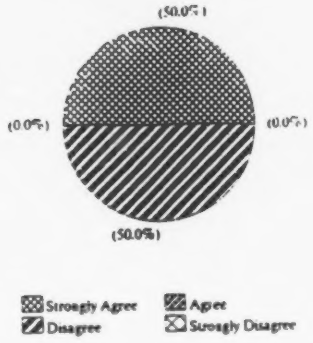
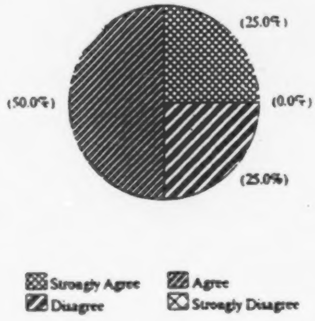

Small Companies


Large Companies

With the exception of large companies, all categories of respondents were quite diverse in their responses. Questions that arose were: 1) Should all intermediaries possess some degree of technical expertise ? 2) Should intermediaries be viewed only as a gateway to various contacts and technical resources? 3) Should intermediaries that only offer non-technical services be viewed as adding "less value" than those offering technical services? Bottom line - it depends. Some representative commentary included: "Surely networking avoids the necessity for tech expertise to be in-house in all circumstances" "You are assuming the intermediary is technical. I am a marketing intermediary and do not feel restricted by tech discipline" "Better to have T2 expertise - more important than technical expertise" and "Too many 'content-free' brokers."

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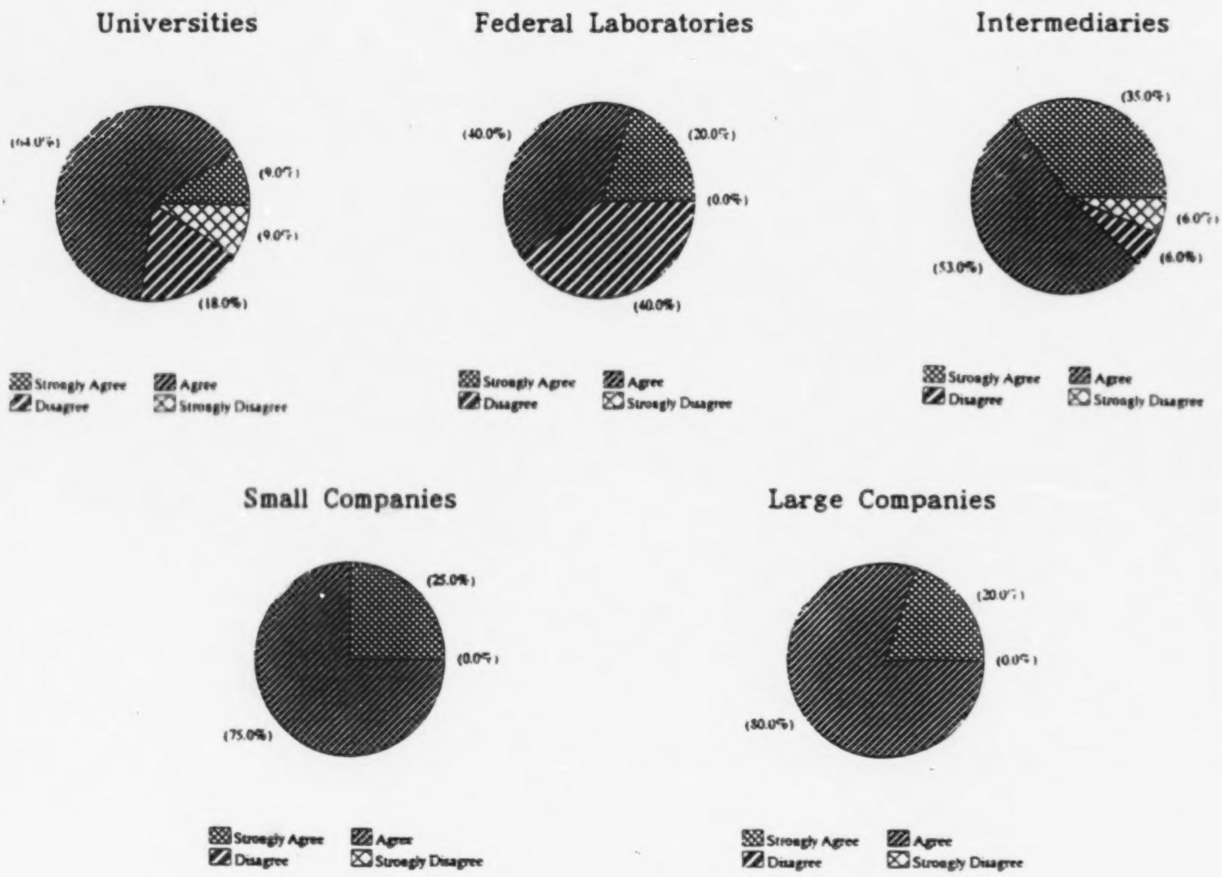
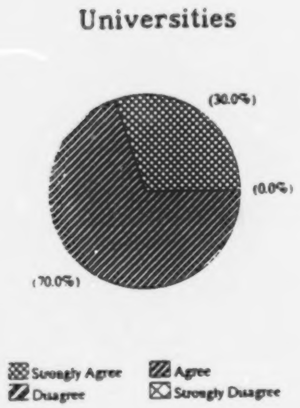
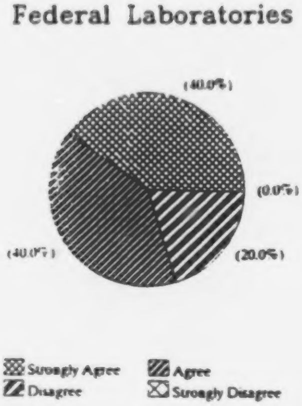
C: 3. There is a fundamental cultural and communication disconnect between technology-driven public sector researchers and market-results-driven private sector business decision makers.

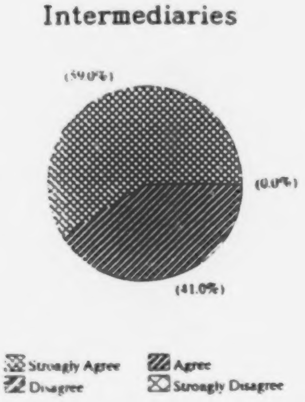


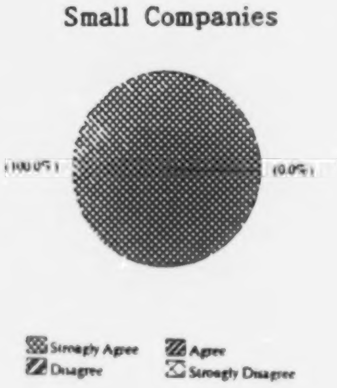
It's painfully apparent that the private sector agrees that a "fundamental cultural and communication disconnect" exists with the public sector. The good news is that 72% of university respondents and 60% of federal laboratory respondents also acknowledge some degree of disconnect. Much of the commentary of the respondents took on an affirmative, positive tool. Some examples were: "This is conventional wisdom but I'm not sure the disconnect is so total at the level of the individual" "But a 'bridge' is possible between the two viewpoints" and "Less so today than in the 50s and 60s where basic research was emphasized."

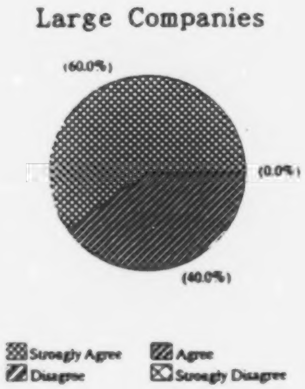
4. Public sector institutions and laboratories must be conscious that companies will show little interest in licensing their technologies unless the technology translates into a profitable product or process with an economic benefit.





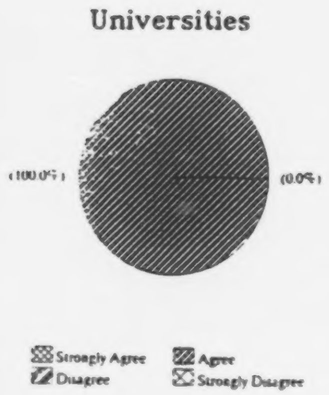


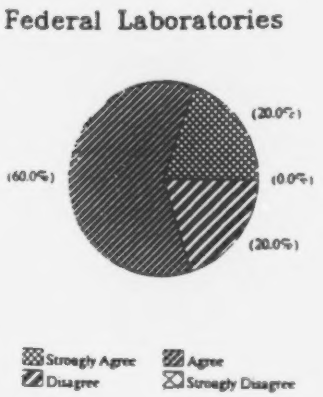


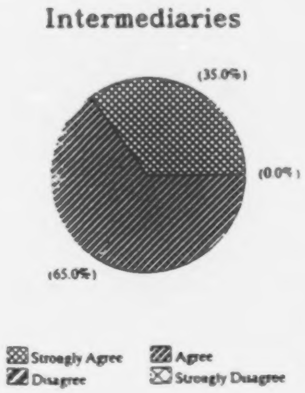


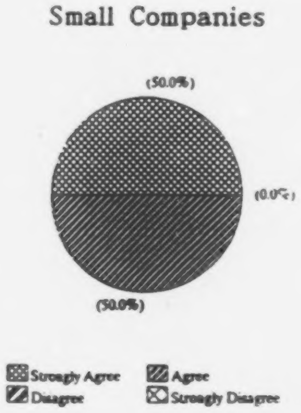
What's striking about the unusually high level of agreement with this statement is the amount of disconnect acknowledgement in the preceding statement. Simple economics allows public sector institutions to grasp private sector concepts such as reward, profit and risk, but unless you are "part of that game" it's difficult to fully appreciate all of the dynamics of private sector, free market economics. Representative comments were, "Invention rarely = product" and "that is the name of the game for industry."

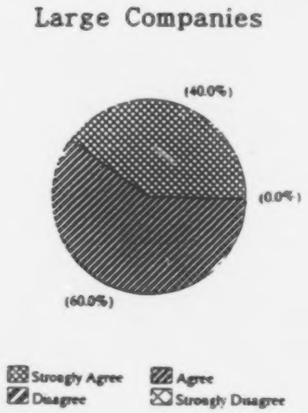
6. Public sector technology sources must develop and implement communication vehicles that document tech transfer opportunities in a manner that is compelling to the industrial/investment community.







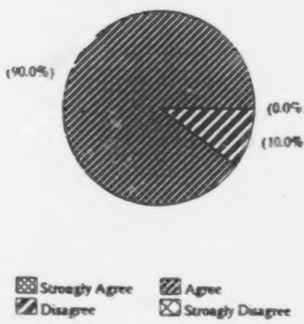




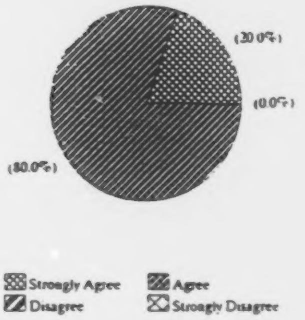
Besides the very high level of agreement with this statement, it's important to note that the public sector institutions themselves acknowledge the need "to communicate effectively to the private sector." In many cases respondents raised the question of: "Should we contract the private sector with the responsibility to design and broadcast the most effective communication vehicles?" Some representative commentary in this area included: "However, it can and perhaps should be private sector sources as communication vehicles" and "...and we aren't familiar with that kind of 'selling.'"

7. There is a role for tech transfer intermediaries in bridging the gap between scientists who communicate through technical reports and industrialists/investors who communicate through business plans and financial documents to make decisions about investment in technology.

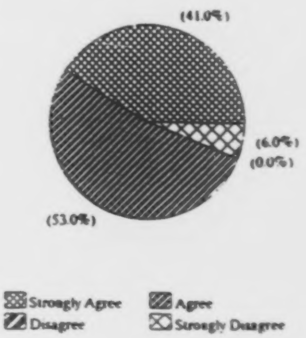
Universities



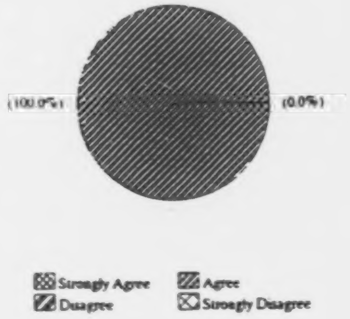
Federal Laboratories



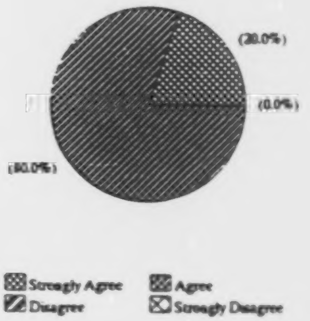
Intermediaries



Small Companies



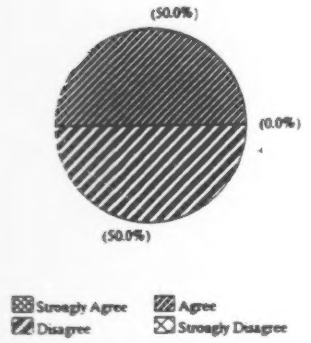
Large Companies



A large portion of the intermediary respondents, as expected, strongly agreed with this statement. What is somewhat of a surprise is that the majority of intermediaries only responded with general agreement. Some respondents questioned the rule and the need for intermediaries at all. Some representative commentary included: "Sometimes, with sophisticated parties it is not needed" and "But let the scientists explain their ideas to industry - their attitude is important to future transfer of 'know-how.'"

8. To reduce the "culture gap" problem, private sector companies, especially small ones, wishing to establish a relationship with a federal laboratory should seek out laboratories that emphasize programmatic development rather than basic research because such labs work routinely with private sector organizations and present fewer cultural disconnects.

Federal Laboratories



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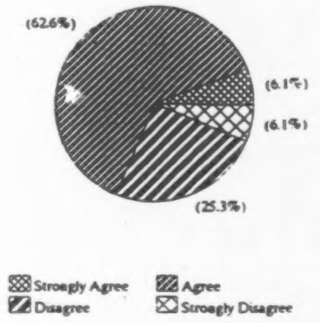
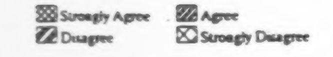
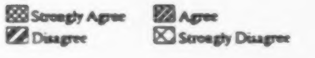


Small Companies

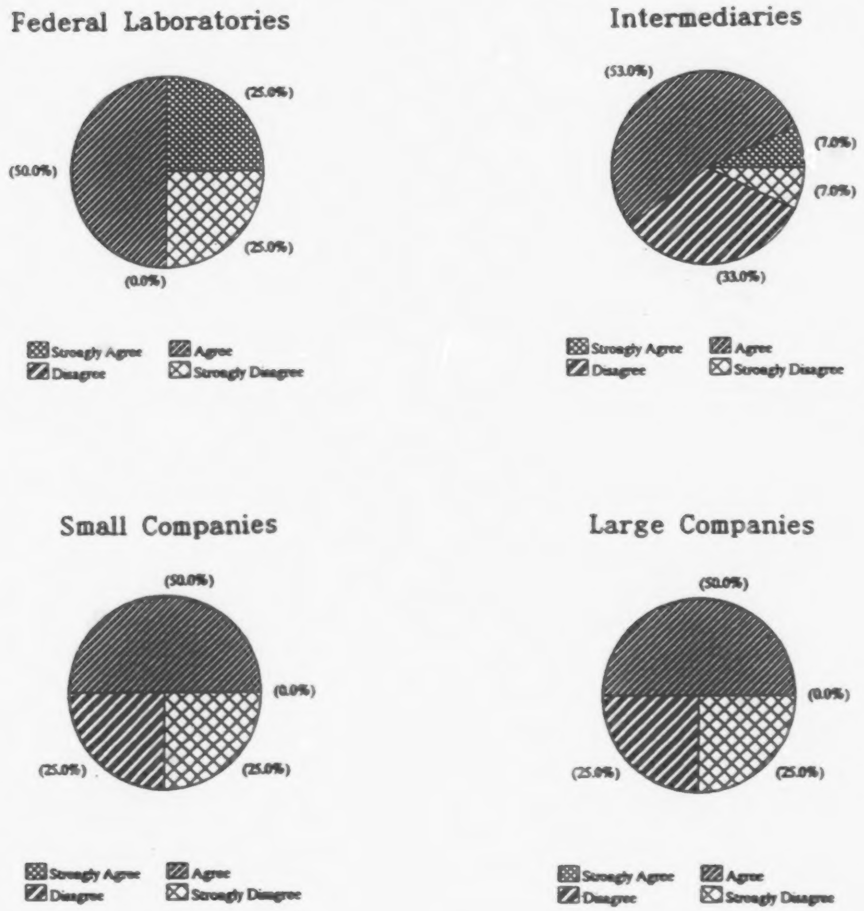


Large Companies



There is significant disagreement with the premise of this statement. Bottom line is: 1) Go to where the technology is. 2) Network with the researchers that interface with the desired technology. 3) Pool whatever resources are required and get the job done. Some representative commentary that reinforce this were: "Seek out good tech wherever it is" "Sometimes the very best technologies spin-off of the big basic research projects. Companies want the technology, I will work with the culture" and "Small technical companies are often run by technical people who are able to communicate with and benefit from basic researchers."

12. The most effective instrument yet devised for defining joint development relationships and responsibilities between private sector companies and federal laboratories is the CRADA.



As anticipated, when the CRADA was described in the statement as an "effective instrument," it evoked diverse and strong feelings depending upon the operating environment of the respondent. Private sector respondents had more negative feelings toward the CRADA and typical of the responses was, "CRADA's as currently constructed are too frequently legal/bureaucratic nightmares." Even in cases where there was "agreement," the agreement was not overwhelmingly enthusiastic and is represented by comments such as, "Yet not ideal" and "so far, it's all that we have!"

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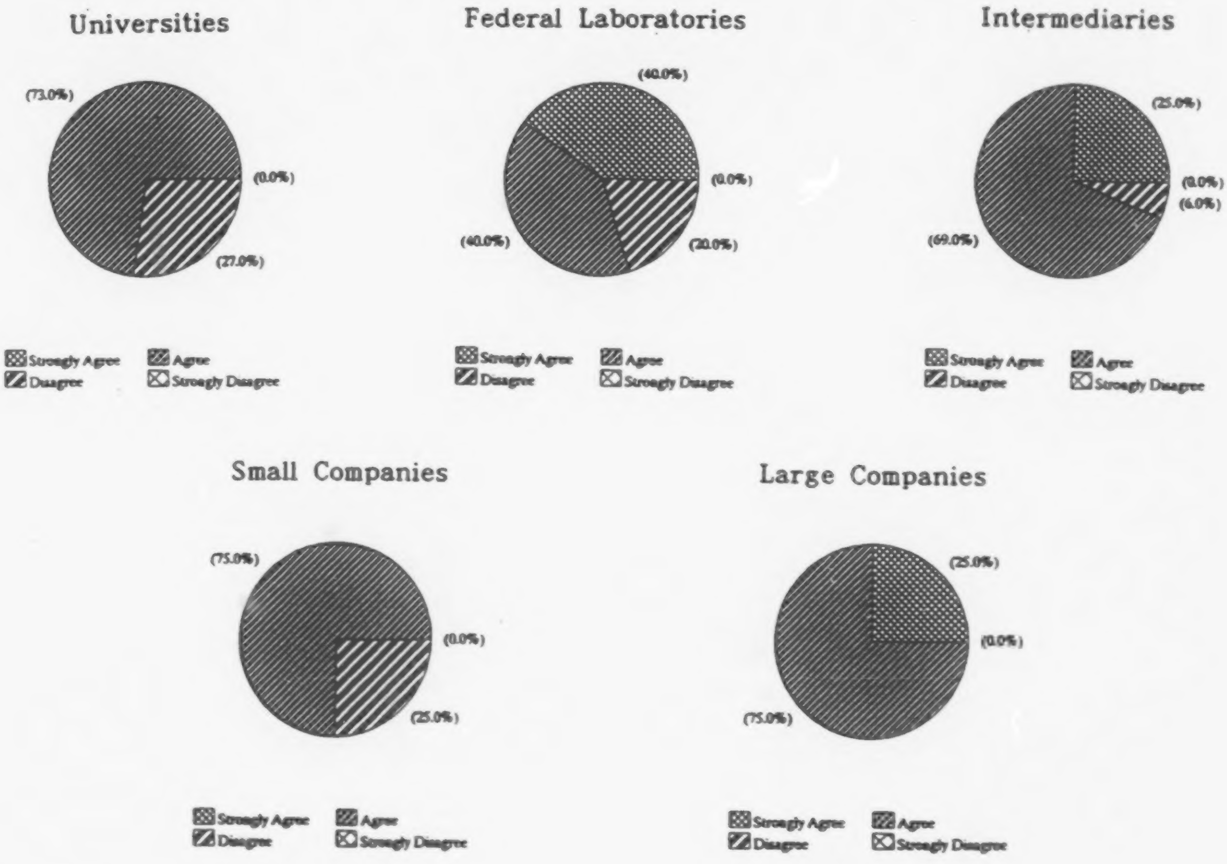
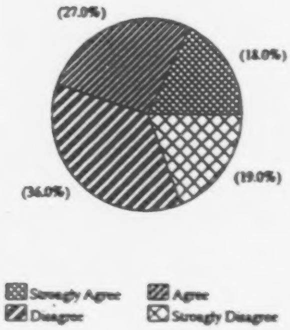
13. Federal laboratories should build communication contacts at the state and local levels by using intermediaries such as community colleges, vocational-technical schools, state agencies and local university-based tech transfer intermediaries.

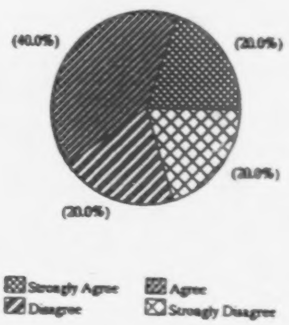


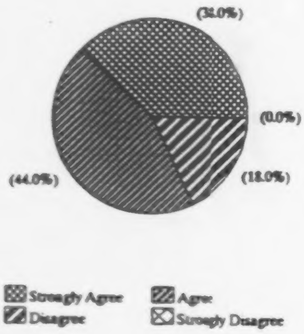
There is a perception among some respondents that communication linkage between federal laboratories and vocational-technical schools/community colleges is a mismatch. There is not a high degree of elaboration for the mismatch, however those respondents who voiced these opinions made comments such as, "However, community colleges and vo-tech folks may bring lower level projects not appropriate for the lab."

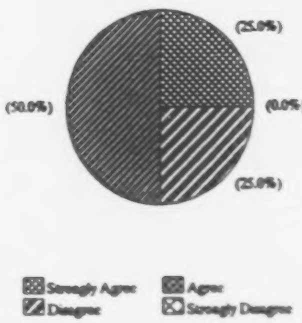
An additional point of concern is why 27% of the university respondents "disagreed" with the federal lab connection. Universitites may feel that they already have a "full plate" in attempting to effectively address the internal technology needs and requirements. A response in this area was, "University technology transfer offices are not in good position to handle transfer from federal labs."

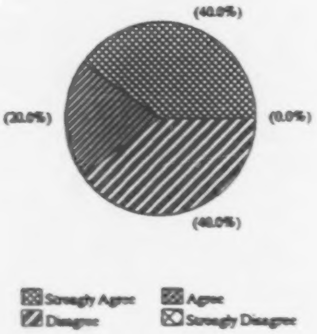
17. Searching for a particular topic (technology) in the public sector research institutions and laboratories is accomplished today by reviewing topical literature, professional society journals, newsletters and through such contacts as the National Technical Information Service (NTIS), the Office of Science and Technology Information (OSTI), the Federal Laboratory Consortium (FLC) and various private sector for-profit databases. A more integrated "one-stop-shopping" approach is desperately needed.


Universities


Federal Laboratories


Intermediaries


Small Companies


Large Companies

Surprisingly, there was a relevant amount of disagreement with this statement among all categories of respondents. Even more surprising is the range of responses. Some of the extremes are, "It will never happen," "NTTC is providing it," "Impractical!" and "Sounds rational but could be overwhelming and too centralized." This last comment also addressed a secondary point of contention with this statement, which is "one-stop-shopping." Many respondents felt that one-stop-shopping was not only impossible from a logistical point of view, but also had the potential to create monopolies of information. A typical comment for this concern was, "Potential licensees search the patent literature because they usually want some exclusivity."

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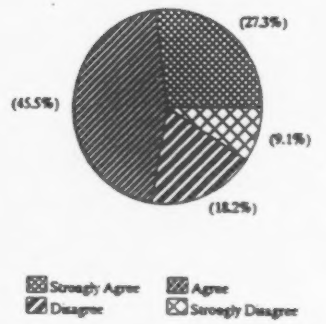
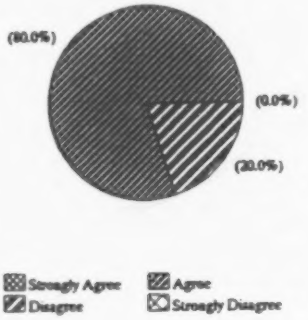
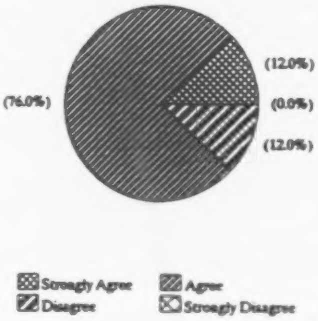
18. Universities should list their new technologies in an electronically scanable database that, ideally, would be integrated with those featuring federal technology.


Universities


Federal Laboratories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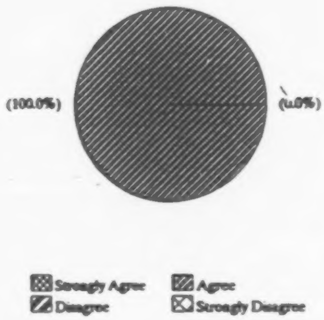
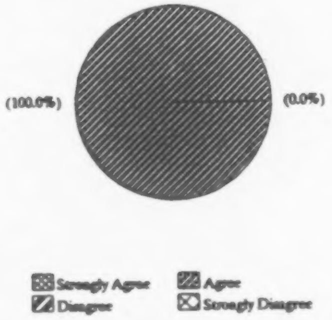
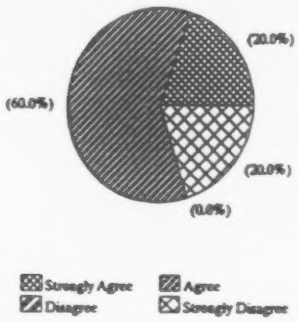
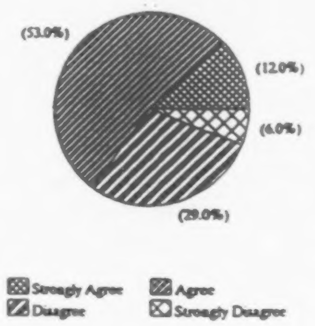

Small Companies


Large Companies

This statement brought forth positive feelings from the private sector. Companies seem to like the approach of electronic cataloging of both federal laboratory and university technologies in an integrated format. However, comments such as "Good idea" were tempered with comments such as "Source should be less important to company than quality, relevance. Then access." Some respondents felt that this service was already available represented by comments such as "They do: Knowledge Express; Best." and "Knowledge Express is doing this with the U.C. system."

20. To be effective, intermediaries need initial access to the technical expertise of a given federal lab through a single point of contact.


Federal Laboratories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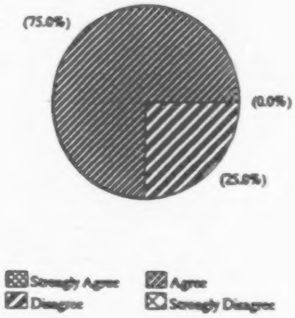
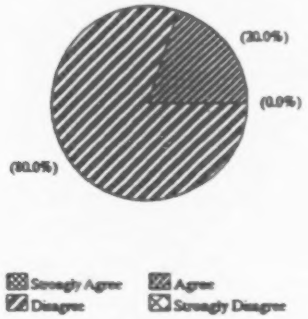

Small Companies

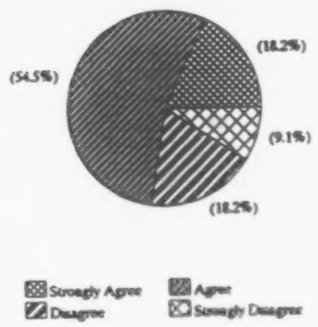

Large Companies

Large corporate respondents, all of which have significant relationships with numerous federal laboratories "disagreed" with this statement. Why? They believe the approach to a federal laboratory should be a multi-level to multi-level interface (i.e. engineer to engineer, manager to manager, etc.) Representative comments included, "Single points of contact look neat and tidy; may in fact function as a choke point." This also is part of the reason why many large corporations have less than warm feelings toward intermediaries. They already know how to contact the ORTA. What they need to know is what bench-level scientists are working for what manager in what department at which lab in what state and how do we begin to promote the multi-level communication linkages at this site? Certainly, this degree of knowledge and service is beyond the scope of many intermediaries.

D: 1. With some technologies, a university may determine that it does not have the knowledge or resources to bring a technology to a state of maturation where it can be readily transferred.

2. In such cases, the university should partner with a large company that has the front-end depth to accept immature technology and grow it.

Universities



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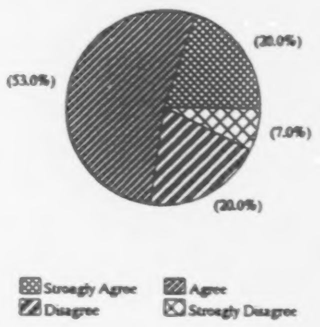

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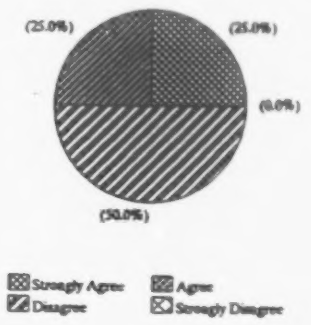
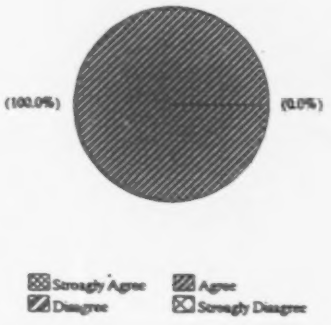


Large Companies



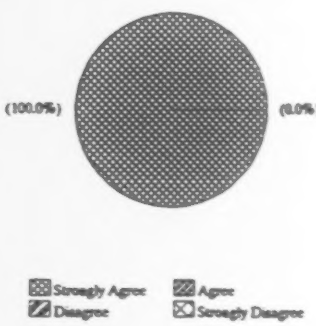
It can be safely stated that there is broad general "agreement" with statement 1. It is with the second statement, specifically "...university should partner with a large company..." that drew the most fire from the respondents. The feeling was that "large company" was both too restrictive and discriminatory toward small and medium sized enterprises. Typical of the commentary was, "The university should partner with the entity that has the best chance of success with the technology," "size is not the measure - commitment is," "Should not exclude willing small companies," and finally "But small entrepreneurial firms may have unique skills as well." The positive aspect to this commentary is that it was expressed by respondents from all the categories, not just the "small business" category promoting their own self interests.

3. Successful technology-based companies must be continuously aware of emerging technology that could impact their market.

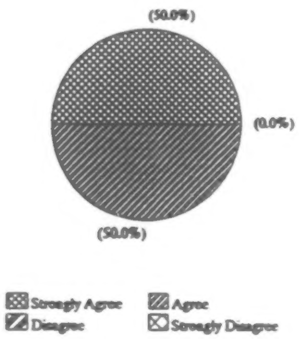
In general there was very strong agreement with this statement. In particular, one respondent state, "Couldn't agree more - we've seen this in the medical technology arena."

4. These companies must perform some inventory maintenance that includes networking with public sector research institutions and laboratories to keep abreast of technology progression and direction.

Small Companies



Large Companies



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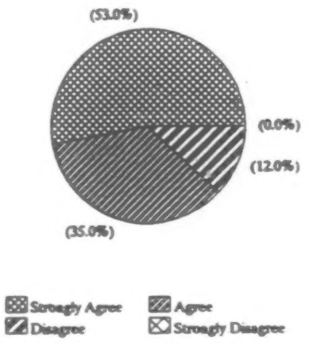
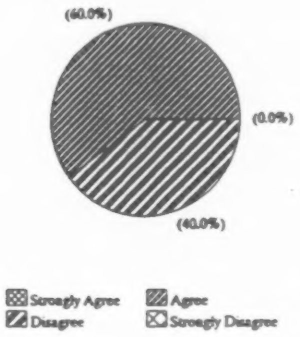
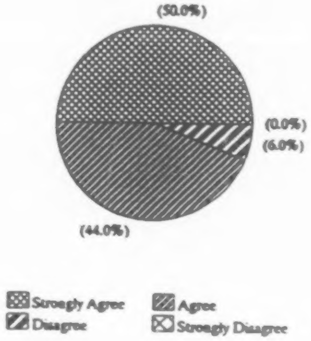


In response to statement 4, there continues to be general agreement among all categories of respondents. It should be noted that in reference to the statement, the concept of technology "gatekeepers" was brought out with commentary such as, "A duty of the technology transfer executive (Chief Technical Officer/CTO)," and "Good technology 'seekers' are very effective in this case."

8. To effectively address the technology needs of small business, federal technology extension services, such as NIST's Manufacturing Technology Centers, should focus on those capabilities which provide their client with proven technologies as opposed to leading-edge science.


Federal Laboratories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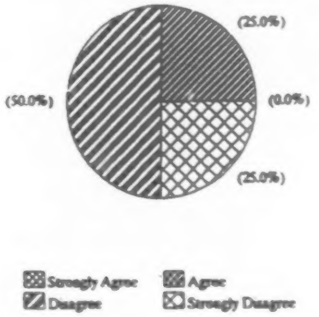
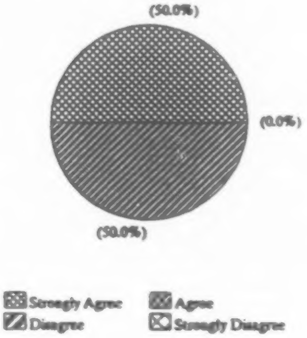
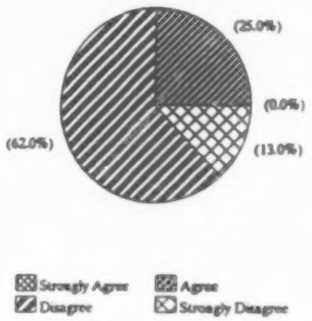

Small Companies


Large Companies

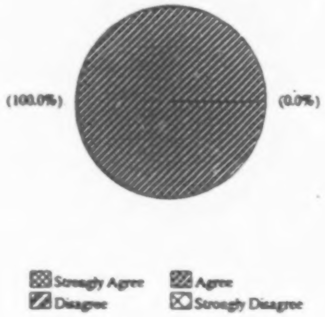
With this statement, the highest degrees of agreement come from large companies and intermediaries. This is the more conservative approach. However, small companies and federal laboratories tend to take a broader view and perhaps riskiest position. This is reinforced by commentary from a federal laboratory that stated, "On the contrary, industrial progress depends on the continual upgrading of capabilities; insofar as possible, the small company should be encouraged to acquire the most advanced technology it can assimilate." On the other end of the spectrum, one intermediary commented, "The fed role, here, is only to spread the economically feasible technologies ahead, not to push the newest technologies too far."

9. Organizations seeking to enter into tech transfer projects with small manufacturing businesses should have internal capabilities that include expertise in the areas of CAD and manufacturing systems that can help solve routine production problems and improve productivity.

Universities



Federal Laboratories



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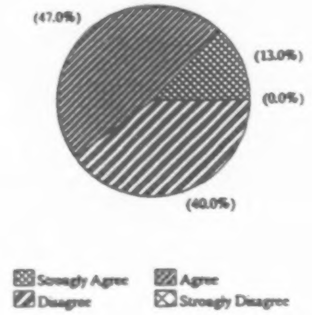

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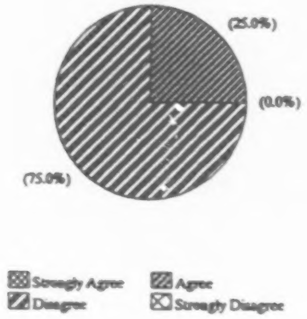

For a variety of reasons, there was a significant amount of disagreement with this statement. Some of the comments redress the disconnect between large public sector institutions and small business. One university simply responded, "Not our job," while another stated, "Helping small manufacturers improve their manufacturing processes is an entirely separate issue."

From the perspective of small companies, most felt it was not the role of the sender/source of technologies to possess these capabilities. However there was some importance to the technology receiver to possess these capabilities. A comment to reinforce this idea was, "The manufacturer must have this, not the 'transferee' (in general.) In specific cases such as an 'engineering' or 'manufacturing' oriented institution, there, capabilities would probably exist."

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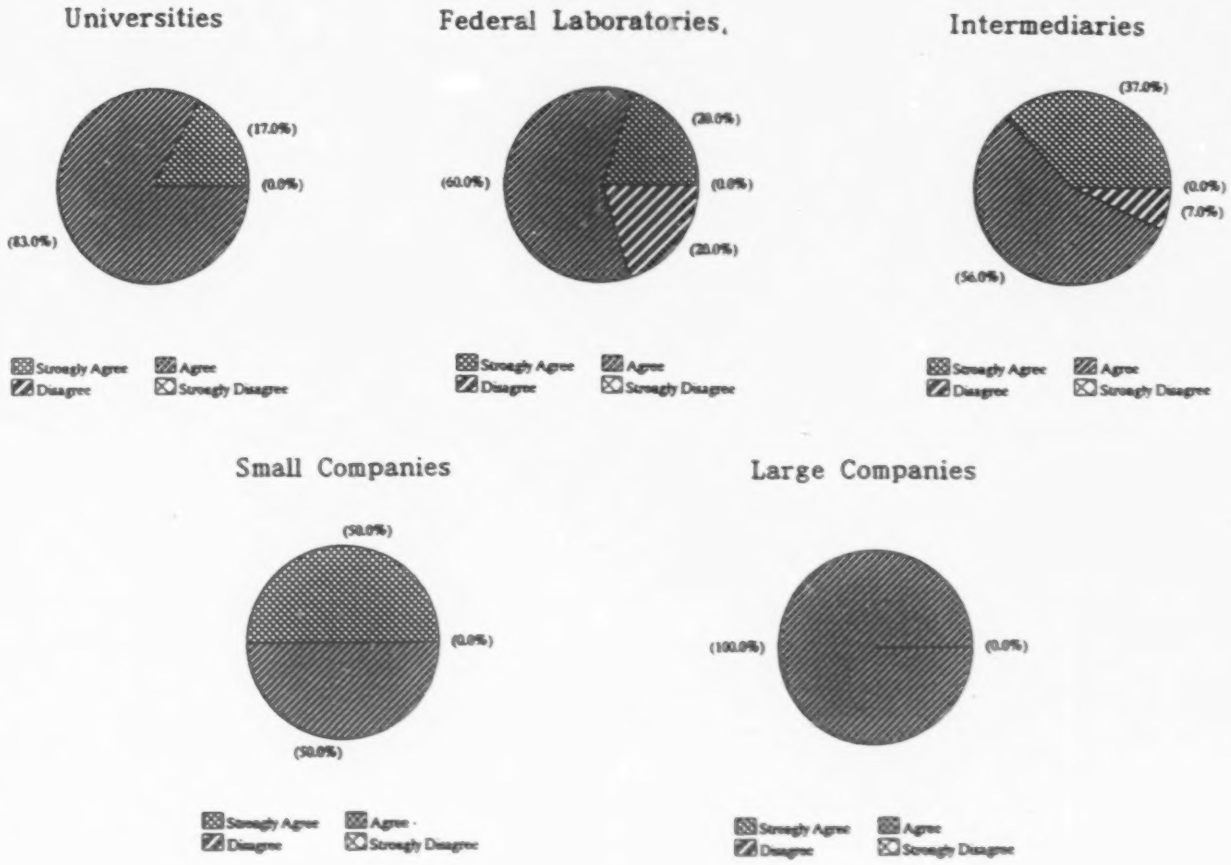
10. All research institutions should maintain, both electronically and on paper, an inventory of their capabilities, areas of expertise of their personnel, and specialized research facilities.


Universities

Federal Laboratories,

Intermediaries

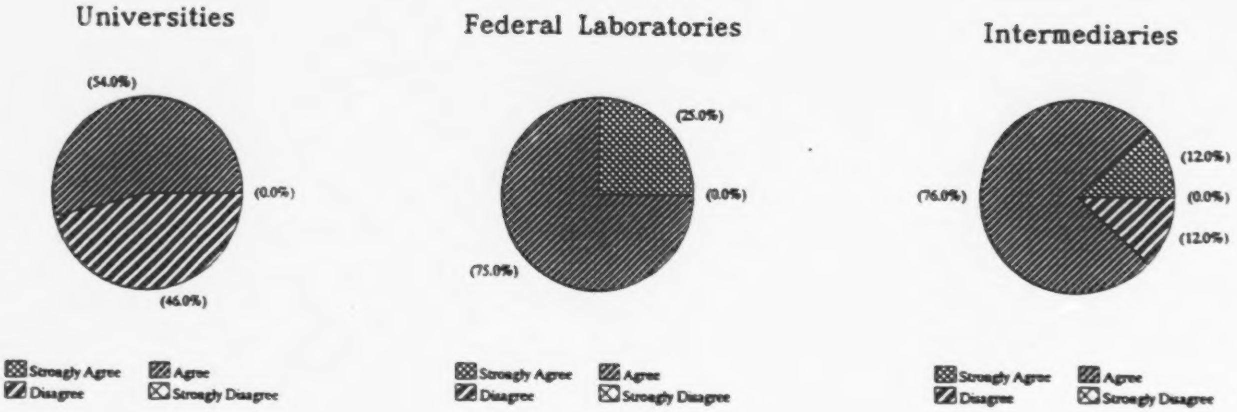
Small Companies

Large Companies

There is broad general agreement that this is a practice that should be followed, however many of the respondents, especially those from large public sector institutions, felt that time and resource constraints prevented them from aggressively pursuing this. Typical commentary included, "However, this is quite difficult in large institutions. Schools may have better capability but with scarce resources and manpower, this is often not feasible."

A second issue mentioned concerned the format and east of access for parties outside of the institution to be able to make a determination that the personnel/equipment/technologies/etc. are those they need to discover and exploit. One intermediary commented, "Very useful, particularly if all labs use the same format so the combined database can be searched."

13. Public research institutions must realistically and carefully appraise what they have to offer -- benchmarking their capabilities against the best of their peers, worldwide, is a useful vehicle for doing this.



Although the federal laboratories and intermediaries generally agree with this statement, universities were decidedly mixed in their response. In particular, they were concerned about benchmarking other institutions that were true peers. Representative commentary included, "I agree this is a useful vehicle, but there are many other ways to evaluate oneself as well. We must be careful about comparing apples to oranges."

In addition to finding a true peer is the question of exactly what measures provide the best information that can be analyzed and evaluated. One respondent comments, "I'm not sure what the measures should be. Perhaps actual utilization?...or patent or paper citations? Prestige?"

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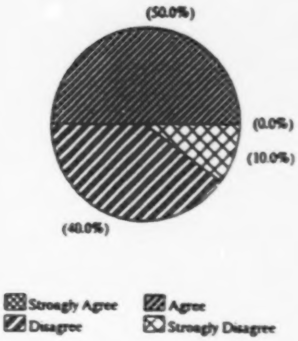
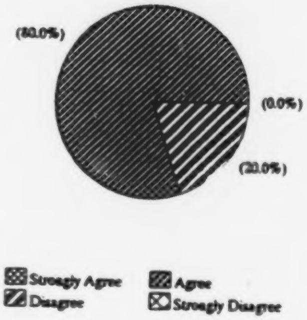
14. All research institutions or R&D departments should be put through a technical audit every 2-3 years for the purpose of identifying non-productive R&D activity.

Universities



Federal Laboratories



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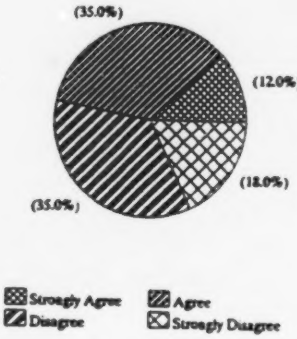
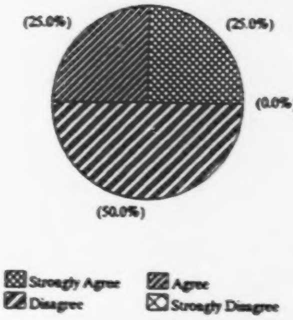
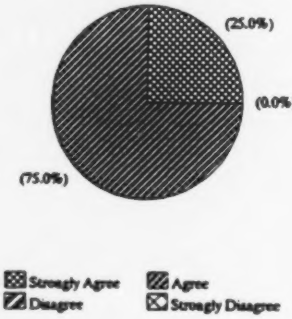


Small Companies



Large Companies



To say that this statement struck a nerve would be an understatement. Large companies and federal laboratories "agreed' with the proposition while universities and intermediaries were equally divided between "agreement" and "disagreement." Commentary from large companies and federal laboratories respectively included, "It's a necessary evil that 'weeding' must be done or you will erode your resources." and "This is a risky issue and often is controlled by a parent agency."

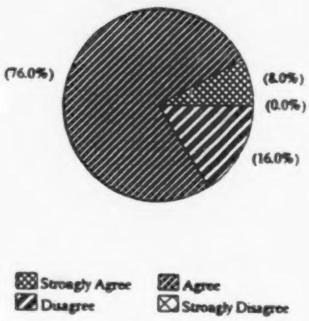
An additional point of contention is "how' and "who" has the capability to judge what is "non-productive R&D activity." Universities feel that the marketplace (i.e. type of research dollars available and how and where they are spent) will define productive R&D activity. Commentary from universities and intermediaries respectively included, "This is not workable at a university since research direction is at discretion of faculty. Funding patterns tend to establish value of research programs," and "What does non-productive mean?...Does it mean negative results? If so, what happens to lifelong quests of Nobel quality?...A better audit - identify stupid or frivolous research. But why wait 2 - 3 years?"

E: 1. Public sector research institutions must build market bridges to the private sector.

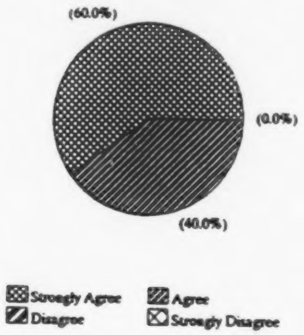
Practical techniques for doing this include:

2. Use of "bench level" scientists and engineers as links to their colleagues in the private sector.

Universities



Federal Laboratories



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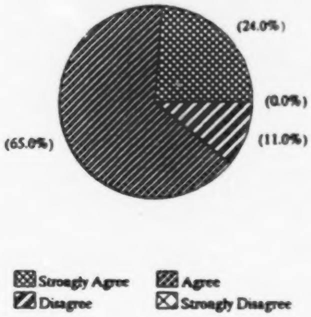
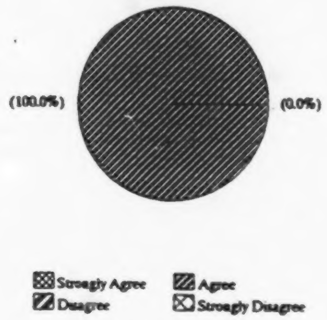
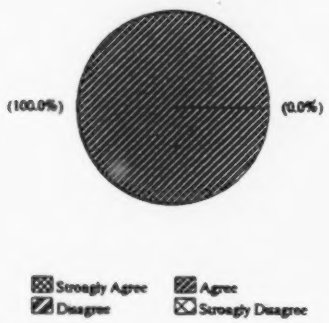


Small Companies



Large Companies



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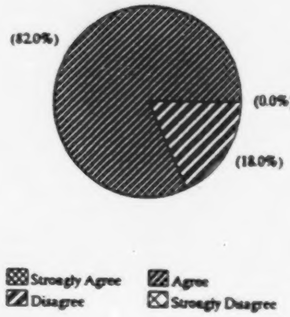
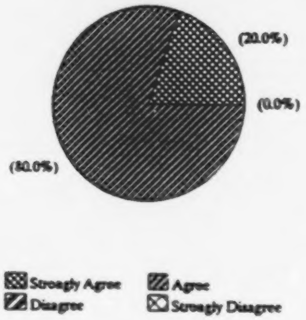
3. Use of the technology's inventor as a marketeer to assist in making the necessary industry contacts and in describing the invention and its potential uses.

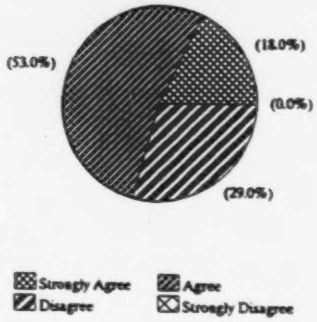
Universities



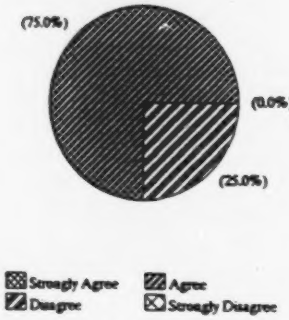
Federal Laboratories



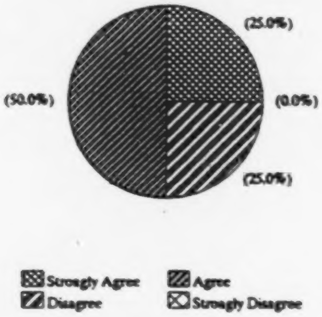
Intermediaries



Small Companies



Large Companies



With two noted exceptions, all of the respondents generally or strongly "agreed" for the need of public sector institutions to develop and implement mechanisms that facilitate the market linkage to the private sector. Federal laboratories seem to be much more attuned to this need than universities. In fact one federal laboratory stated, "Not only market bridge but technical bridges."

Use of "bench-level scientists" as communication facilitators to the private sector is a well accepted idea. One respondent stated, "This is the primary mode of contact." However, there were two respondents who voiced words of caution from two different areas. They stated, "Bench level scientists and engineers often have no knowledge of the marketplace" and "Link required at all levels. Easier here (bench level scientists) because they have most in common."

Statement three sparked more "disagreement" mainly due to placing the scientist/inventor in a position where: 1. They have no skills or interest in marketing a technology. 2. Pride and ego begin to obstruct any potential the technology may have to offer. Representative quotes on this theme included, "The reason many scientists and engineers do these jobs instead of marketing and sales jobs is that they like technical work and do not especially care for 'business.'" "This can have some value but is also problematic because inventors are generally not good marketers." and "Where possible. Some inventors...but even egotists should be exposed to the realities of the market. May help reorient them - even if it hurts sales."

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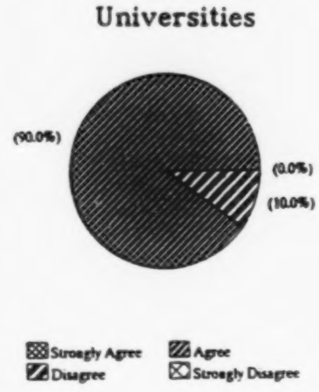
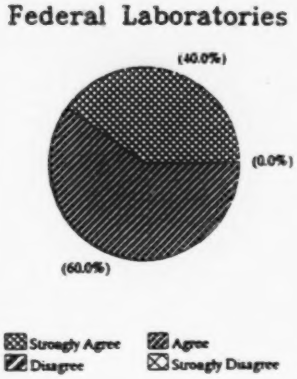
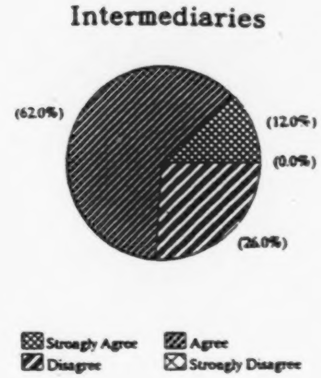
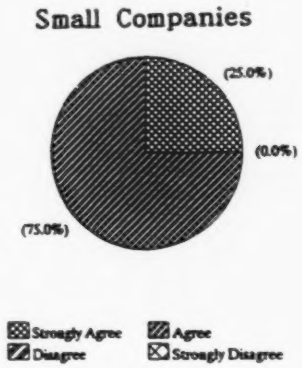
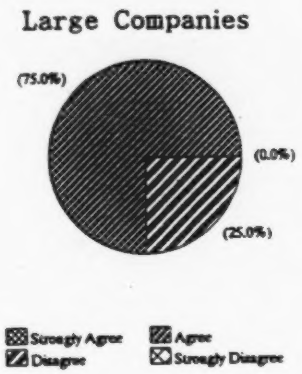
4. Advertising of technologies that are candidates for co-development or licensing.







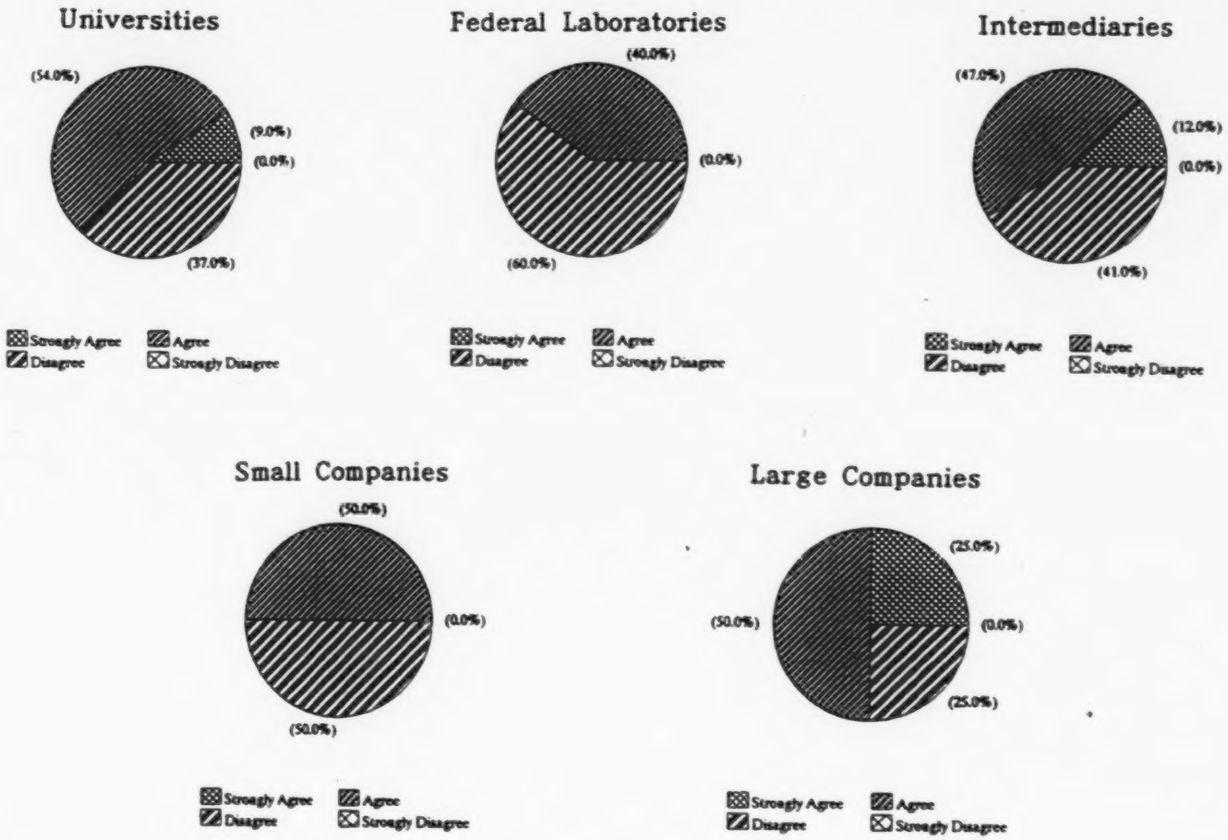




Small companies and federal laboratories are "in sync" with this statement, which is good to see. Both favor the utilization of "advertising technologies" that may lead to some future relationship. An intermediary best summed it up by stating, "No one knows which marketing methods are best for all situations. Must test everything. Advertising is deplored by some ignorantly. Skeptics think advertised technology is 'shopwork', therefore not valuable. But, it is labor-saving way to identify potential buyers, especially for tech with diffuse, varied or even unknown applications. Let them self-select."

Effective techniques for advertising or marketing technologies include:

5. "Road shows" at least once per year where the latest technologies are demonstrated with a practical, hands-on approach.



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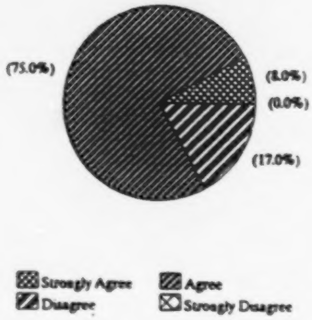
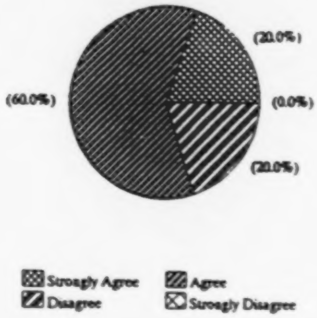
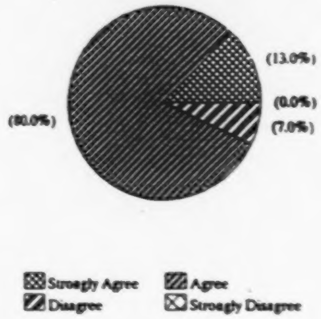
6. Industry-specific seminars to demonstrate technology wares and open the necessary two-way communication between laboratories and the marketplace.



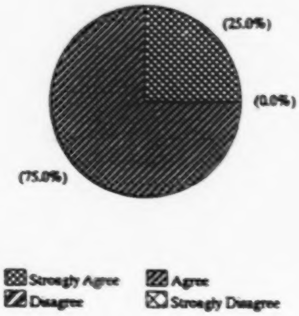
Universities



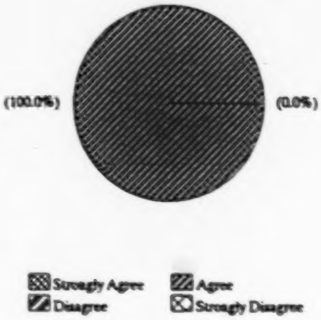
Federal Laboratories



Intermediaries



Small Companies



Large Companies

"Road shows" do not appear to be the most favored method of marketing technologies, according to all categories of respondents. Several concerns were raised and included.

1. Many technologies cannot be effectively demonstrated in this environment

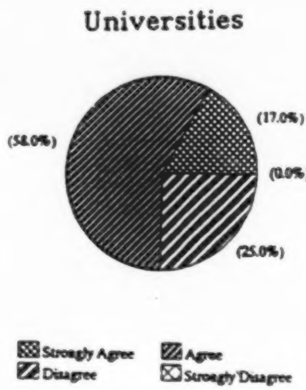
2. It's a "hit-or-miss" approach for discovering potential licensees

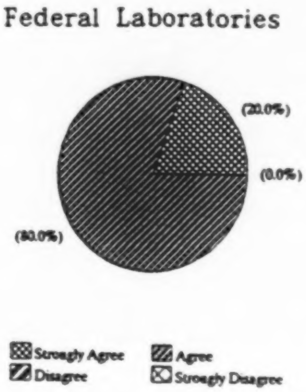
3. They are expensive

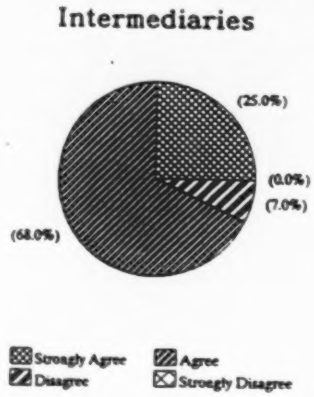
4. They require unique and highly dedicated people to manage and operate them

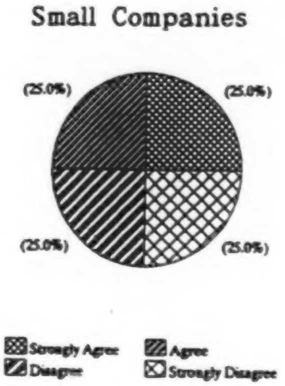
There is a higher degree of "agreement" among all categories of respondents in regard to marketing technologies through "industry-specified" seminars. Through this method, communication would be facilitated due to all of the participants having interest in a common theme and the "targeted approach" would increase the chances of discovering a potential licensee. Positive commentary included, "Topic specific seminars are good." and "Maintain tight focus - avoid non-productive 'technology fairs.'"

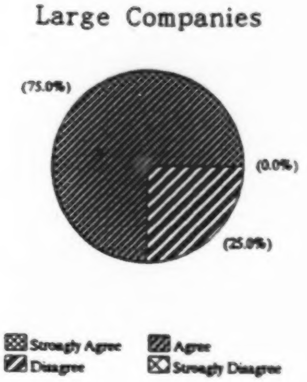
7. To assist in the generation of market pull, greater emphasis should be placed on bringing technologies close to commercial applicability or at least to a state that makes plausible demonstration-type projects possible.





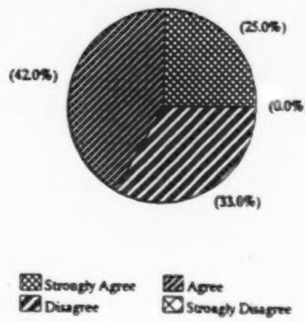


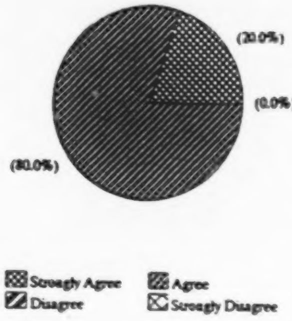


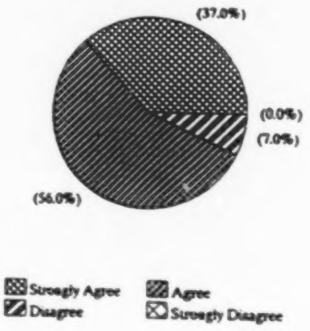


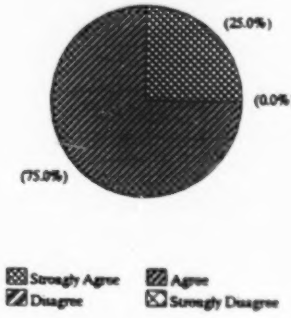
Small companies are badly split over this statement due to at least two reasons. First, bringing a technology to a state of "total market readiness" helps to eliminate many of the value-added development steps that small companies are there to provide. secondly, there is profound concern that organizations who generate technology such as universities, will attempt to develop goods and services with their technology and ultimately discover that no market exists for these goods and services thereby wasting more scarce resources. Representative commentary to this statement included, "The university is not geared to be concerned about commercial applicability but is concerned about scientific merit." "No! Rarely does an institution know/understand customer or market." and "98% of TT will re-engineer the technology for manufacturability, useability, serviceability and will repackage. Don't waste $ on commercial quality in the lab."

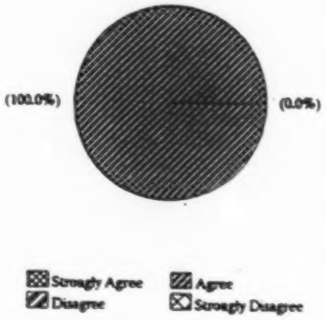
8. Through a combination of internal or external sources, the tech transfer office must gain a thorough understanding of both the technology and its possible commercial application in order to recognize the technology's inherent value in the marketplace.


Universities


Federal Laboratories


Intermediaries


Small Companies


Large Companies

With the exception of universities, there is broad general agreement from all of the respondents. Two university respondents cited what they felt were potential problems by stating, "Some technology receptors do not wish to reveal all applications, market value, etc." and "You can't be frozen in your ideas - there's a wide range of interpretations and users." When carrying forward from the second comment, many respondents felt that the tech transfer office would be stretched too thin if it is required to have a "thorough" understanding of the technology AND all potential applications. One respondent felt, "The most important thing is to understand possible commercial applications rather than the technology per se."

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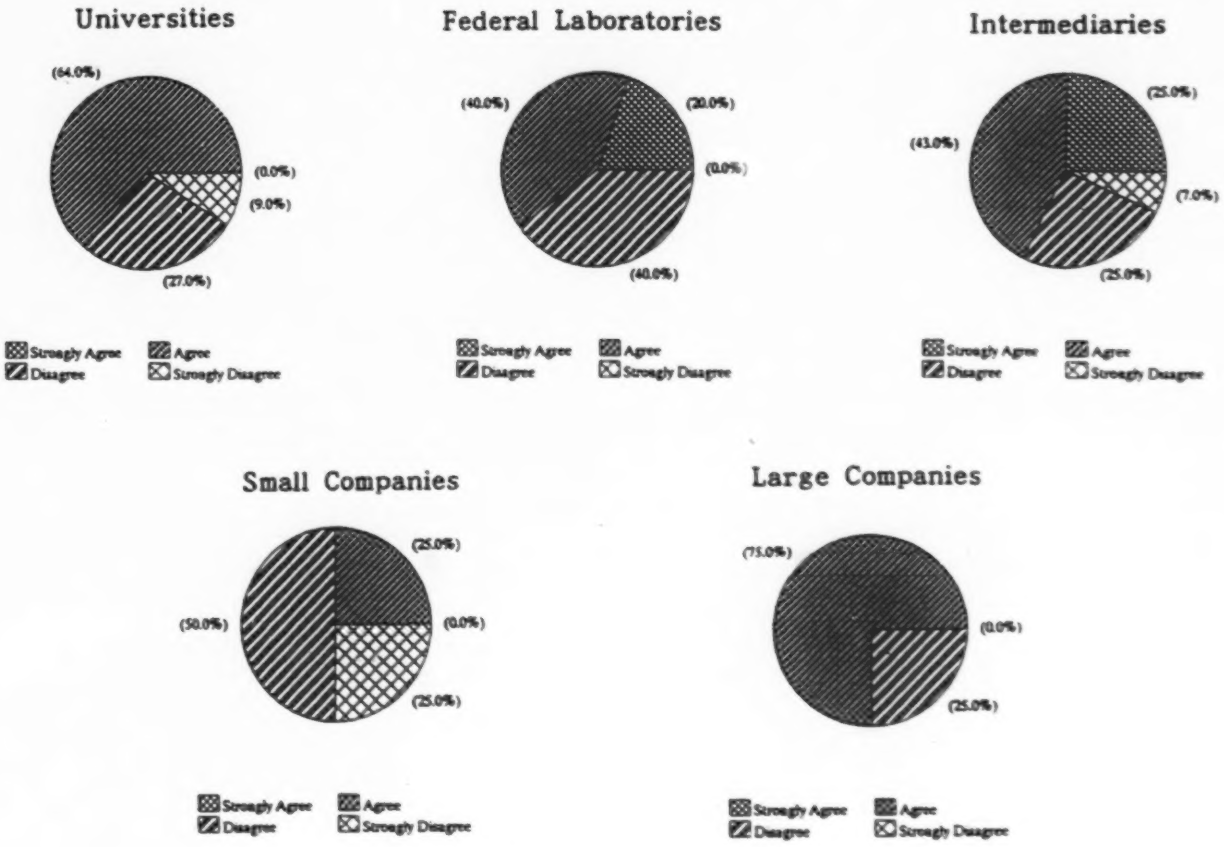
10. An effective tool to assist in determining the market for a technology is to employ business school students to perform a market analysis.


Universities

Federal Laboratories

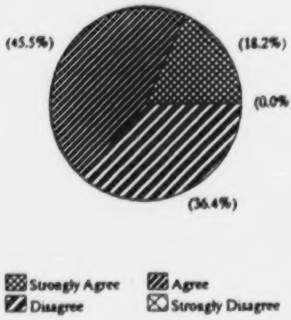
Intermediaries

Small Companies

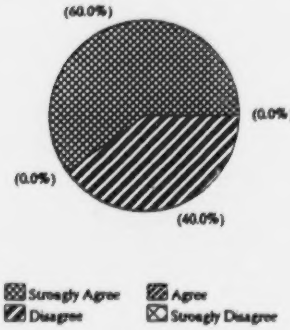
Large Companies

11. Business school students with an engineering background are especially effective in this regard.

Universities



Federal Laboratories



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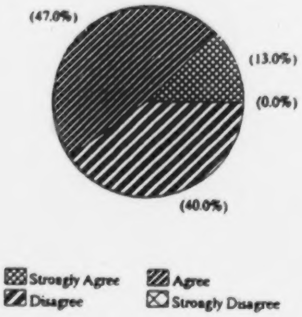
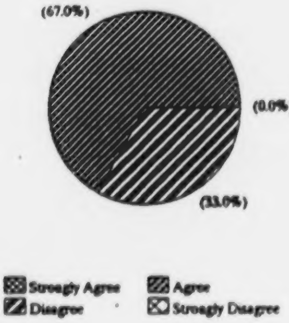
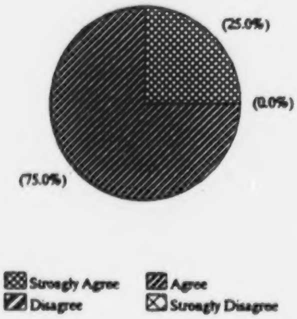


Small Companies



Large Companies



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The respondents were badly split between "agreement" and "disagreement" with this statement. The addition of the three criteria listed below would have made a huge difference toward more positive/agreement responses. They are:

1. Use graduate business school students

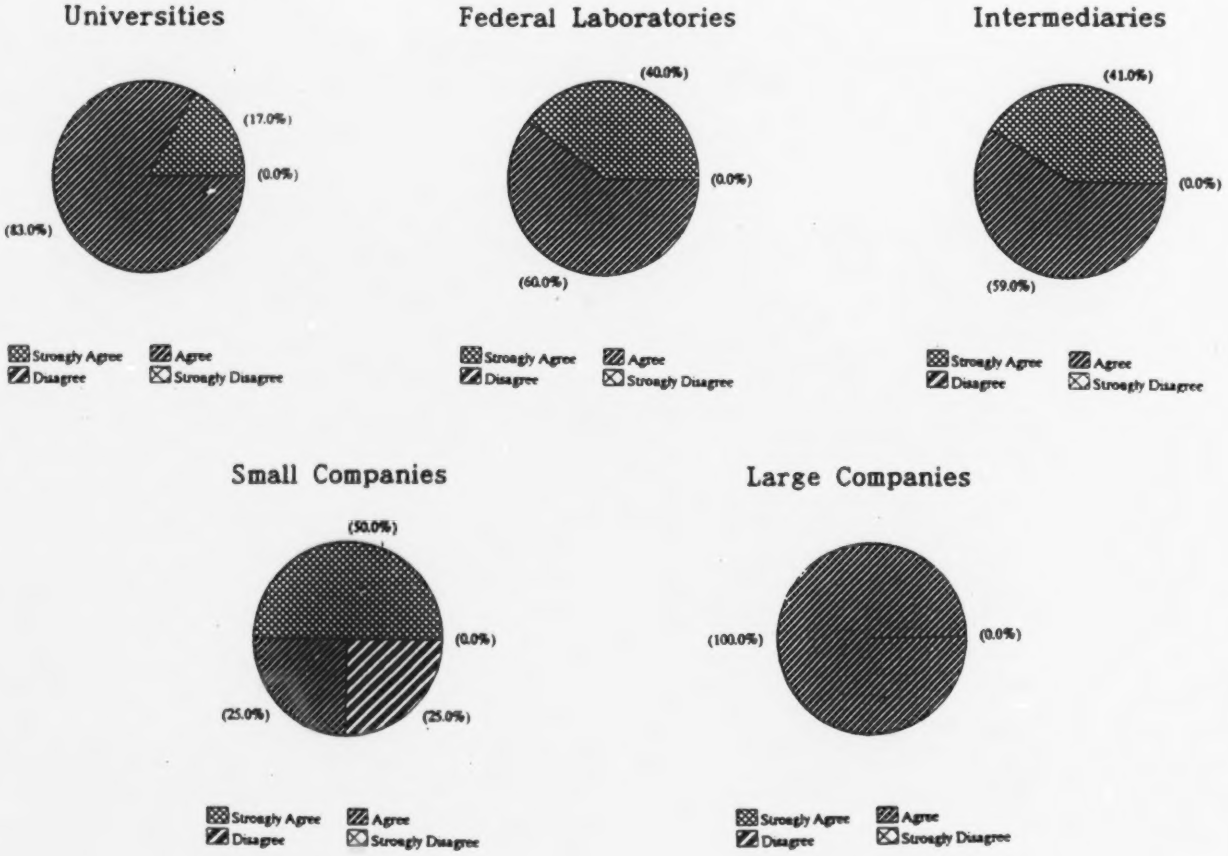
2. Use students who have had some technological/industrial working experience

3. Apply close supervision to the student resource

However, even with the addition of these three criteria, accurate, successful outcomes are not automatic. Some respondents stated, "We've done this, but selection of the technology is important as well as the student (or team) caliber." and "Unless they possess a background in the area of technology and/or can appreciate those nuances that contribute positively or negatively to value."

Many respondents felt that an engineering graduate pursuing an MBA was still not the correct fit to many business-oriented analyzes. One respondent stated, "Maybe for some technologies, certainly not for invention in biomedical/biotechnology area." Some respondents felt that engineering graduates pursuing an MBA would become more valuable as they were completing the final stages of their coursework. One respondent stated, "assuming they are near the end of the business curriculum."

14. A particularly effective tech transfer technique is to demonstrate a new product or process and its benefits to potential customers for the technology.



With one exception, there was unanimous "agreement" with this statement. Fostering the technology push side of the equation becomes infinitely easier when potential customers/licensees are able to utilize tools beyond their imaginations. To be able to touch, see, smell, etc. are all positives when it comes to the decision-making process of whether or not to license a technology. At least one federal laboratory is attempting to "target" its potential licensees for demonstration workshops. They commented, "We often hold focused, well-advertised workshops."

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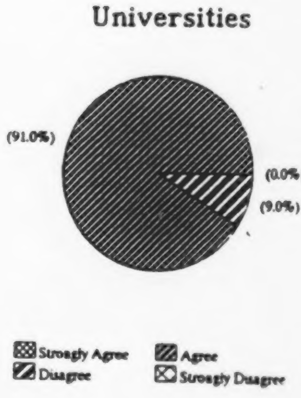
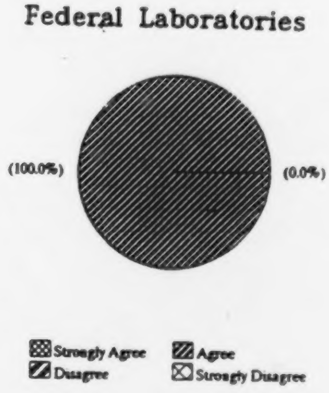
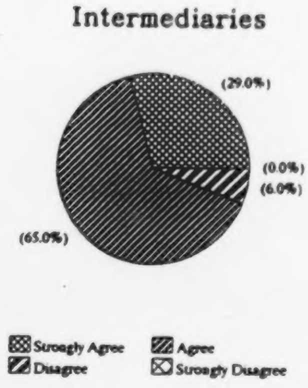
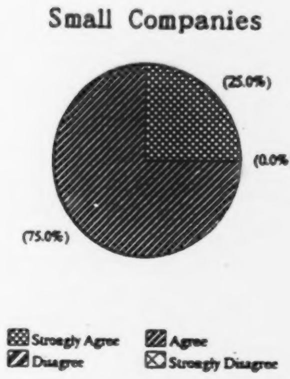
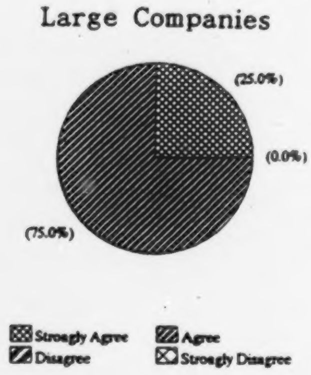
15. Companies that develop technologies and discover through market analysis that demand is "too small" should consider licensing these technologies to smaller companies geared to be profitable at smaller volumes.







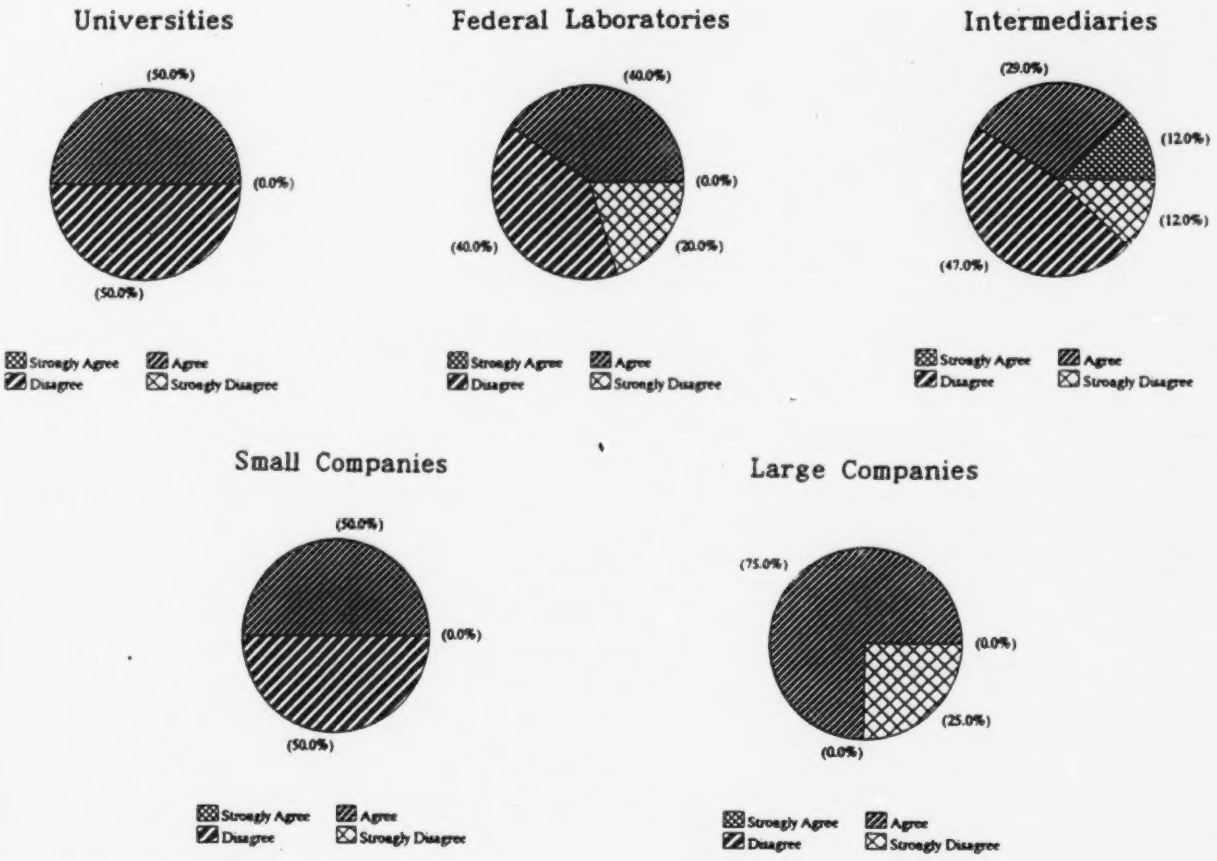




96% of the respondents voiced "agreement" with this statement. However, it would be interesting to find out how many of the Fortune 50 aggressively seek-out smaller companies to produce marketable goods or services based upon technologies they have generated. None of the large company respondents stated that they do this and none of the small company respondents stated that they have entered into agreements with large companies in this regard.

One point of contention that was raised by four respondents was that perhaps the volumes of goods and services are so small that no organization could make a decent profit. Some commentary in this regard was, "I'm afraid this 'smaller volume' angle might be a trap that a small company falls into. If the market is too small, why bother at all?" and "If too small for them, then too small for others!"

17. Small companies desiring new technology should regularly attend federal laboratory meetings such as those sponsored by the Federal Laboratory Consortium (FLC).



Universities

Federal Laboratories

Intermediaries

Small Companies

Large Companies

All categories of respondents, including federal laboratories, found significant "disagreement" with this statement. Perhaps the Federal Laboratory Consortium (FLC) meetings are not really designed to address the small business interface during this time. Commentary in this regard included, "Waste of time. FLC meetings do not yet service end customer of technology." and "As currently configured, these meetings suck and will turn off small companies."

On a positive note, some suggestions were made that might provide more assistance to the small business. Three of these are, "They should visit the labs and get to know the R&D staff," "They would be better off reading the literature and seeking specific solutions to their problems assuming they are so motivated." and "Good for networking, but I would concentrate on the scientists."

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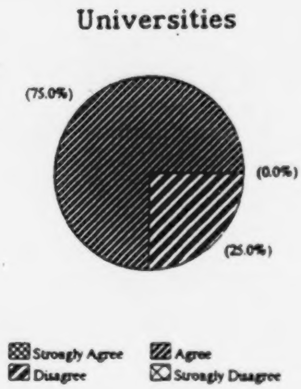
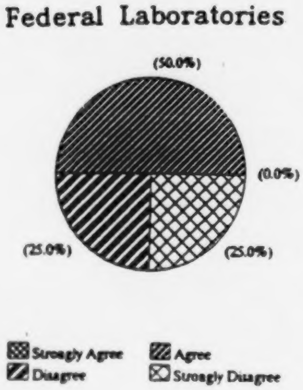
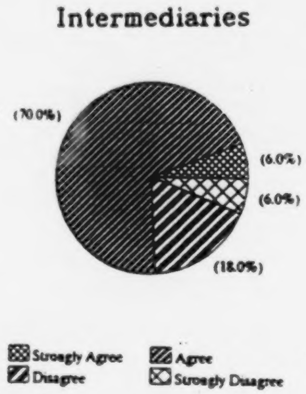
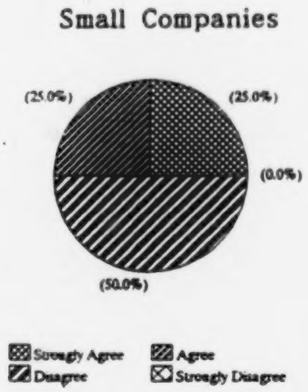
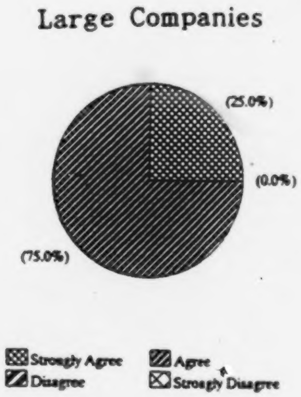
22. Public research institutions and laboratories should benchmark their tech transfer projects and marketing methodologies with those of other public research institutions and laboratories on a case by case, worldwide basis.











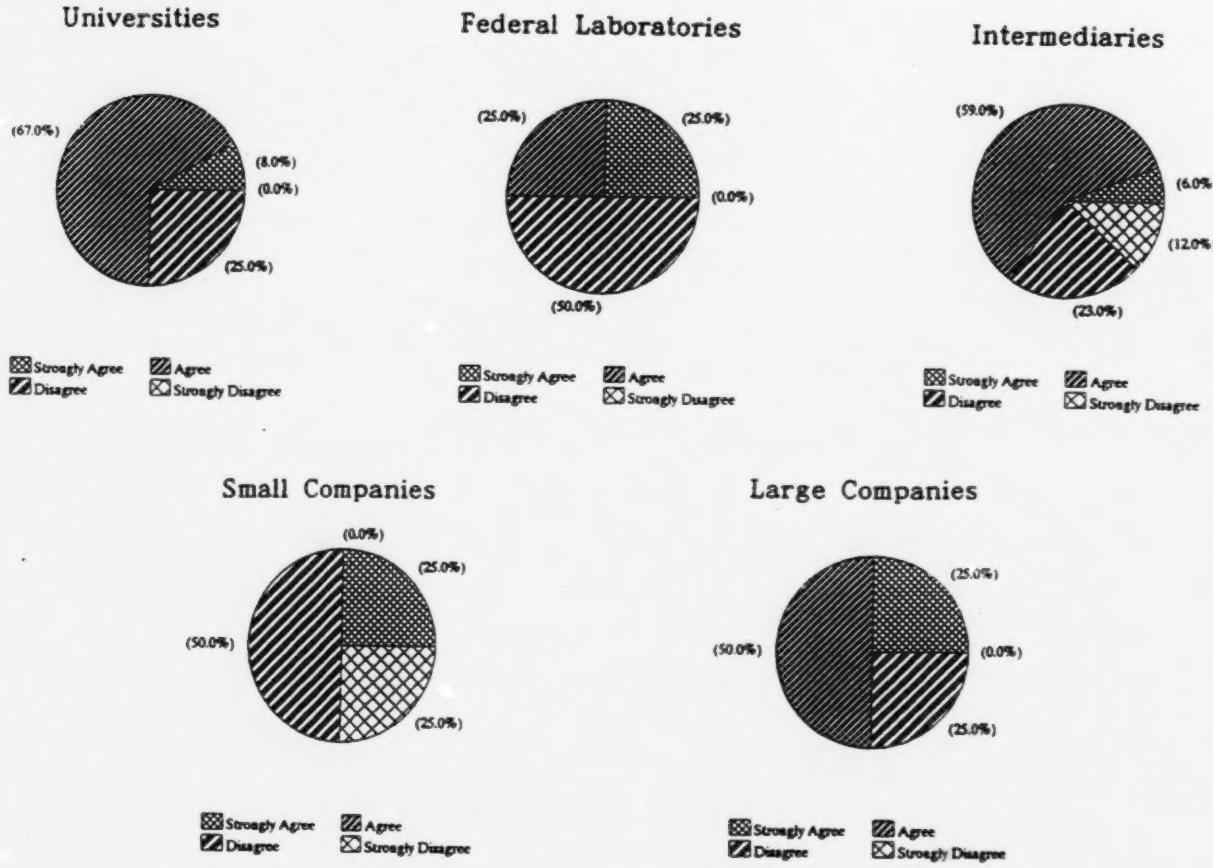
With exception of large companies, a large portion of the respondents chose to broadly "disagree" and in some cases "strongly disagree" with this statement. The concern of performing this task is centered around two key points:

1. Costs in resources vs. benefit of data gained

2. Gaging benefits gained vs. benefits lost of studying T2 processes vs. actually performing/participating in T2 processes

One respondent best summarized this argument: "This type of question seems to assume infinite $ and time. If we try something, then benchmark (often applies to oranges), then try again, then benchmark...we will have invested more in the process than we will even get from the result, and slowed everything down in the process. Instead, identify best practices and effective tools, adapt them to local conditions and get on with the job of TT. These questions all show academic process-oriented thinking that does not fit into the pace required to meet today's needs."

23. To maximize technology transfer potential, universities should closely align their specialty areas (strengths/disciplines) with private sector interests in the surrounding community.



The surprise with this statement is the completely opposite response given by the universities from what the authors anticipated. Broadly, universities thought this idea had some merit while many other categories of respondents thought it was not such a good idea. Why? Because they thought that restricting large academic institutions to investigate technologies that are only of interest on a local basis would risk the long-term health of the university. Representative commentary included, "Most local communities have limited potential to utilize most university technology. With leading-edge technologies, national and international alignments should be made." and "No. The institutions should not in general become locally focused to be viable research institutions. They must have a global focus." It's good to know that those "outside" of the academic institution are willing to vocalize this long-term view.

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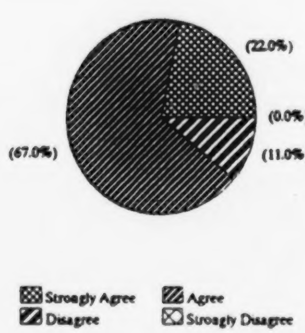
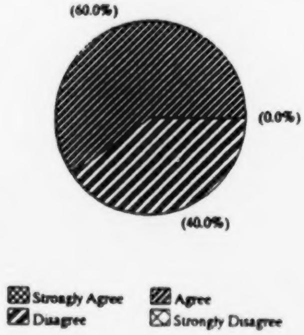
25. Tech transfer intermediaries can provide an important service to private sector companies by scouting the federal laboratories to identify and screen new technologies.

Universities



Federal Laboratories



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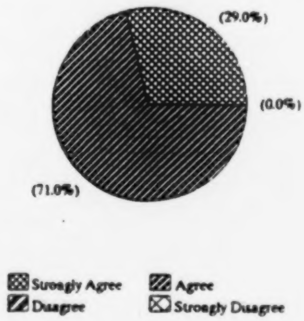
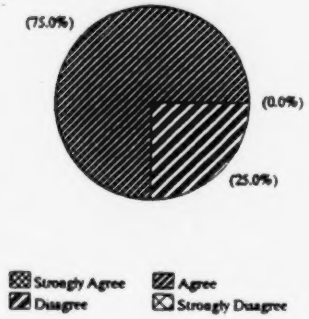
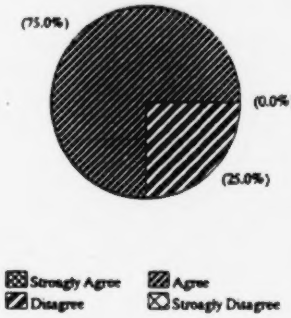


Small Companies

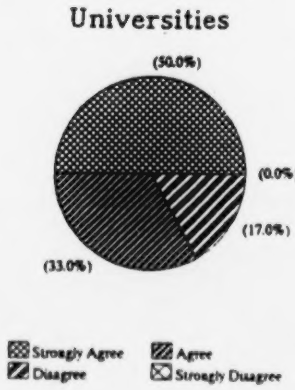


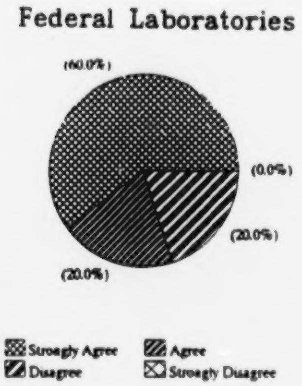
Large Companies

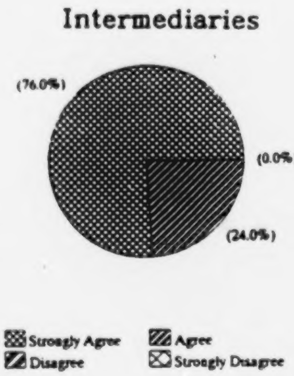


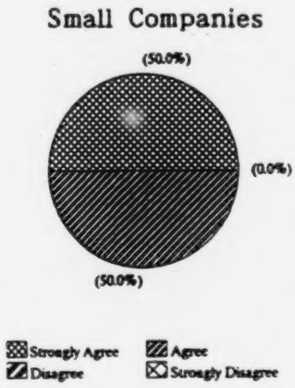
Although intermediaries view this as a valuable service, the federal laboratories and private sector organizations have some reservations. Large companies have some aversion about interacting with intermediaries as the two following respondents commented, "Disagree as to large companies. I agree for small companies." and "Maybe for small companies." Federal laboratories are concerned about the intrusiveness of intermediaries and one stated, "Yes, but don't come nosing around too often or you'll wear out your welcome...the labs have limited time for intermediaries."

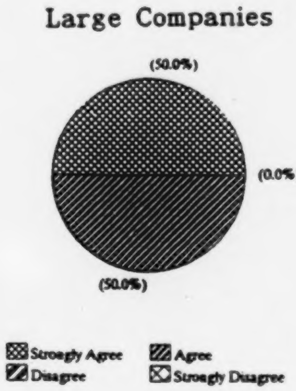
F: 1. All inherently risky activities, including technology transfer, require someone to "champion the cause".



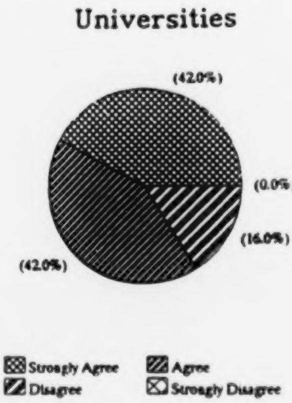


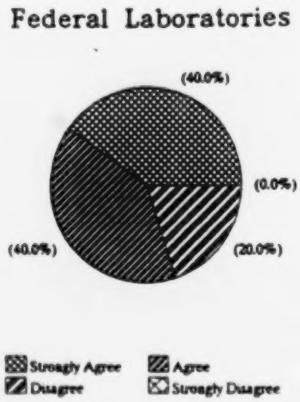


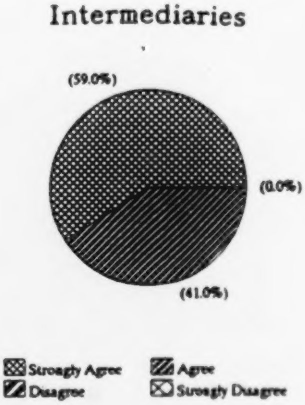


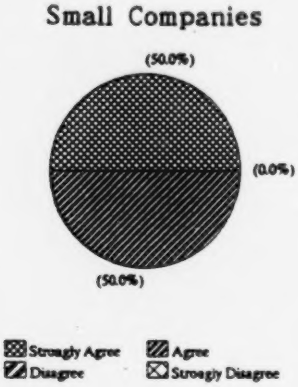


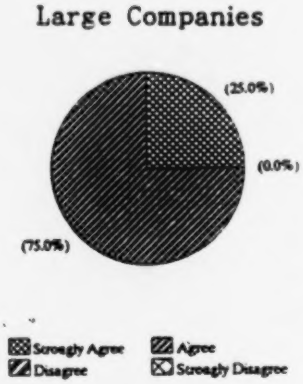
2. The tech transfer project must be able to depend on someone to "drive" the project, "overcome" obstacles,"mediate" disputes,"facilitate" communication,and "bridge" any cultural gap.





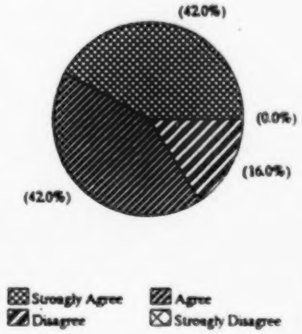


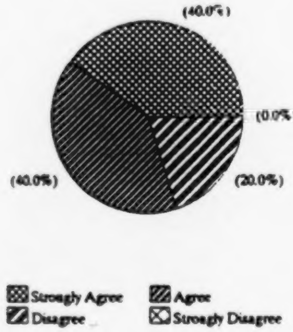


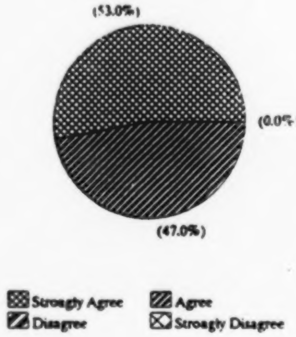


In the eyes of intermediaries and large and small private sector organizations, tech transfer project champions are a required critical ingredient. The argument could be made that intermediaries respond this way from a strictly self-serving point of view. But then one should ask: "Can a removed, independent third party really provide all of the aspects of a champion on both the source and recipient ends of a tech transfer project?" Probably not. One respondent stated, "Someone on the 'inside'." Most succinctly, in favor of champions, one respondent stated, "No champion - no success!"

3. All public sector tech transfer offices must have strong champions at high levels in the administration of the organization -- because payoff is long-term and there will be inevitable pressures to commit the institution's limited resources to meet shorter term goals.


Universities


Federal Laboratories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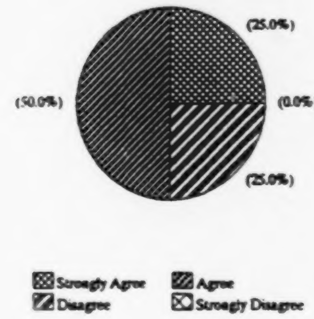
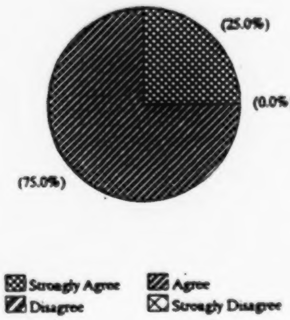
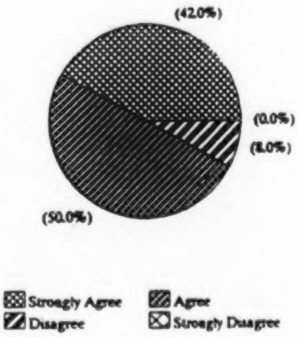

Small Companies


Large Companies

In many instances, the respondents carefully noted the difference in the role of the "champion" at the "administrator" level vs. that of the "researcher/first line manager" level. The respondents felt that the administrator should champion the tech transfer mission of the organization while individual researcher/manager should champion individual tech transfer projects. One respondent commented, "Separate the 'administration' from the 'champion.' An administrative office cannot truly 'champion' too many projects - but individual researchers can champion 'their' work effectively."

4. All tech transfer projects should have two project "champions" -- one on the resource or technology push end and one or more at various levels in the recipient firm to facilitate the receipt of the technology and drive the market pull.

Universities



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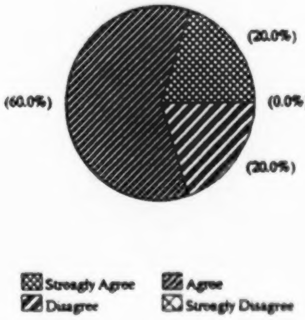

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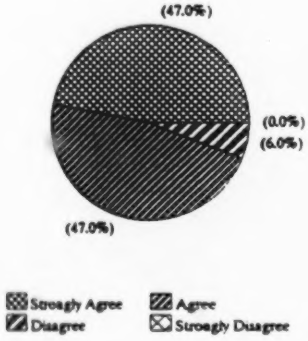

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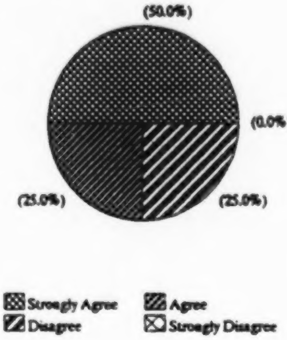

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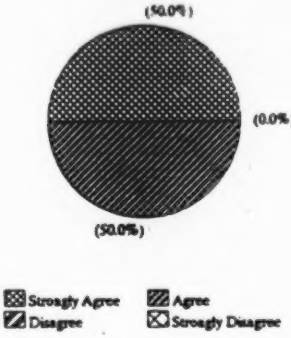
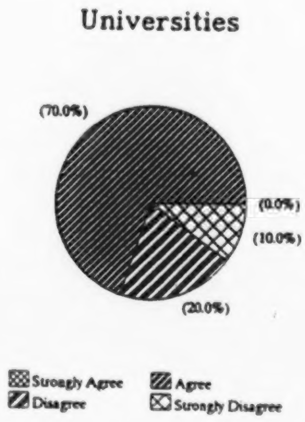


Many respondents generally "agreed" with this statement but also chose to add some words of caution about the complexity of the relationships between the source/recipient firms involved in a tech transfer project. In particular, one respondent noted, "Probably need both business-oriented and technology-oriented people on both sides. Can use intermediary as champion: i.e. Marketing consultant to balance tech focus of technical champion from the lab. I have done this and find it to be key to success."

Other respondents felt that developing this "degree of complexity" in a tech transfer relationship was a luxury few could afford. Two respondents commented, "This is the case usually with projects that are quite large. Small businesses don't have the excess personnel." and "Desirable, but not always possible."

8. Successful transfer of a given technology, require that the technical people involved dedicate a significant fraction of their time (20%?) to the transfer process itself.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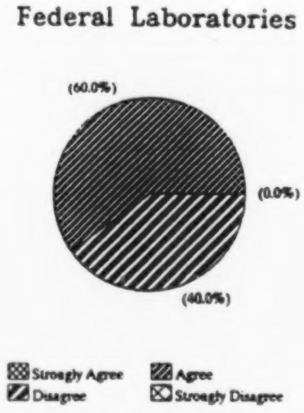
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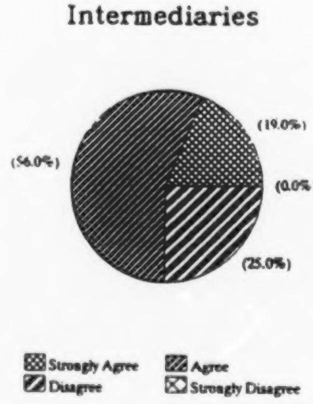
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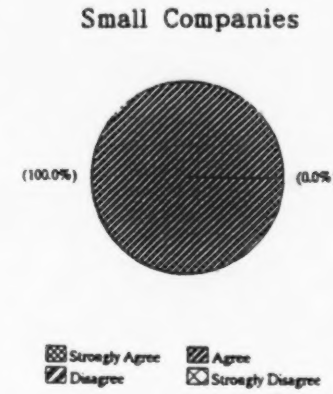
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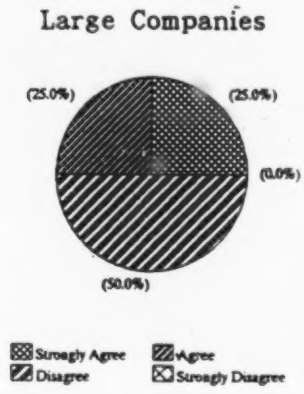
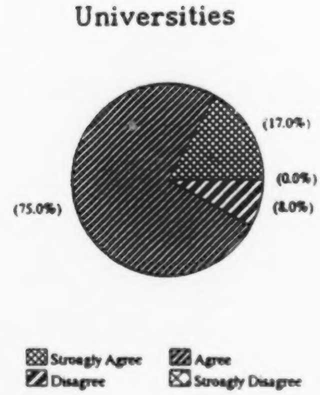
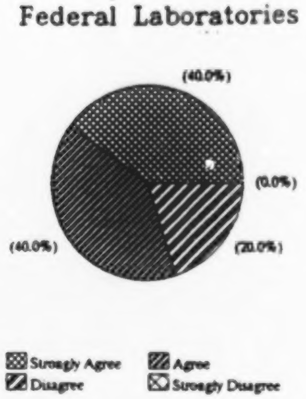
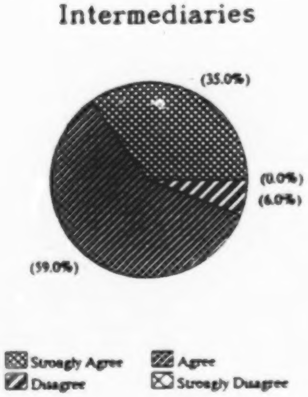

Large Companies

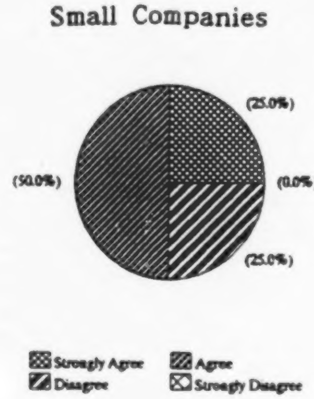
A common theme running through the commentary of those respondents who chose to "disagree" was the observation that "it depends." Specific projects require varying amounts of continuing commitment at different stages in the transfer process. One respondent stated, "This will vary greatly with the circumstances - it may be 50% for certain projects or periods." Another respondent underscored the importance of the "process" by stating, "Failures in process probably kill more projects than technical failure."

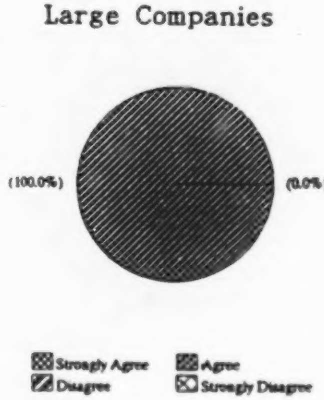
9. To be effective in marketing technology, in a world that demands a customer oriented approach, university and federal lab tech transfer offices must employ full-time staff, preferably with outside industrial experience.





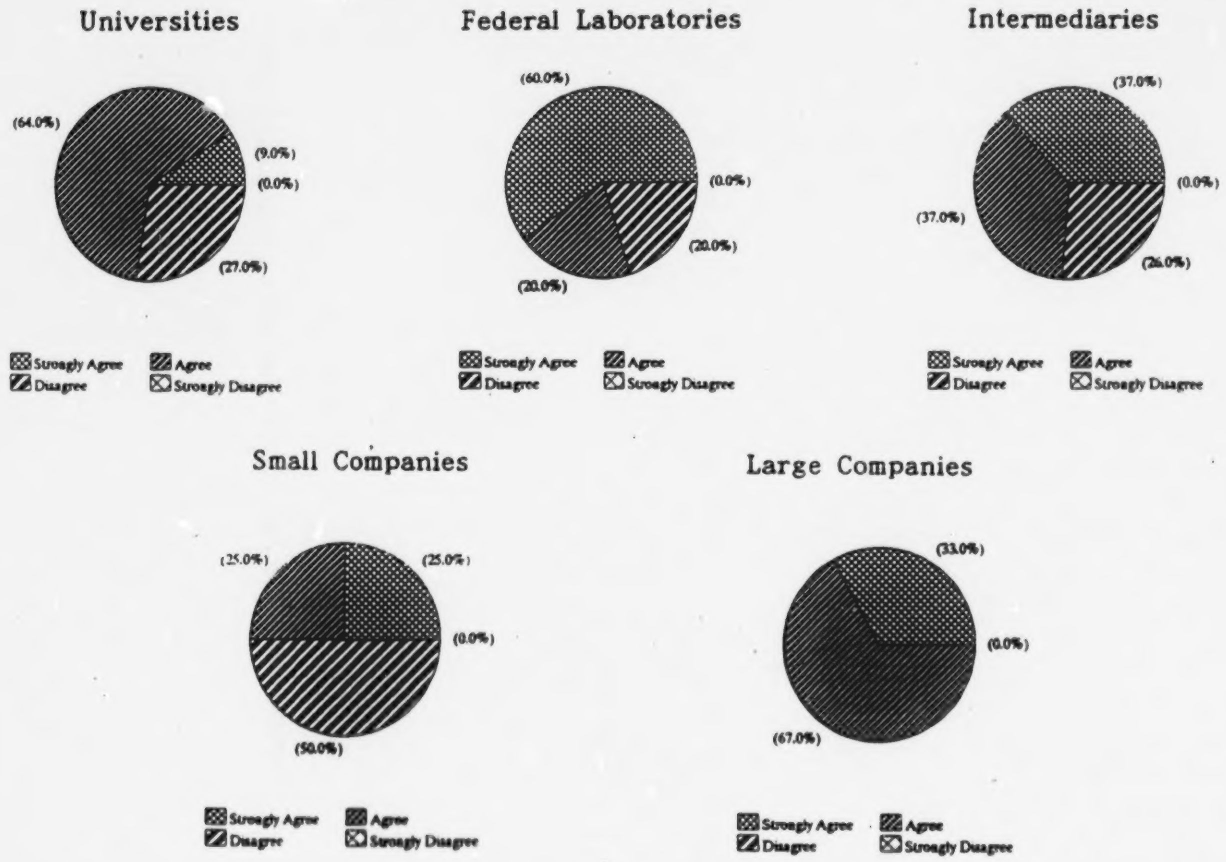






While the respondents "agreed" broadly, but not unanimously with this statement, the differences were telling. For example, two respondents who "strongly agreed" stated, "This is absolutely critical for successful technology transfer." and "This is the ideal situation." A federal laboratory respondent chose to "disagree" and stated, "There are many good ORTAs staff without industrial experience - common sense is a good plus." Such comments underscore the cultural gap that occasionally remains to be closed.

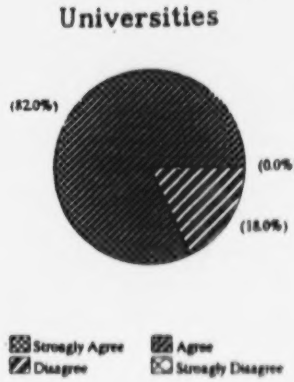
10. Expertly crafted patents are critical to the longer term protection of a new technology.

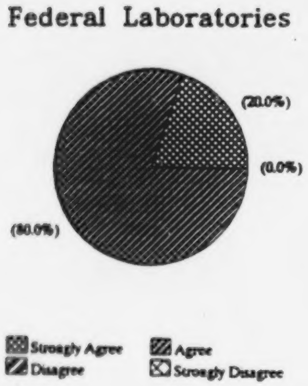


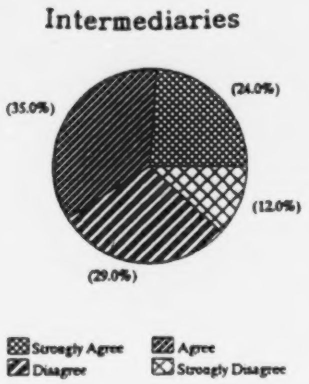
Surprisingly, there are a significant number of respondents who "disagreed" about the importance of carefully authored patents. There is some feeling on the part of some respondents that crafting the "perfect" patent could cost market opportunity. One respondent stated, "Market is more important than patents, which are often circumvented."

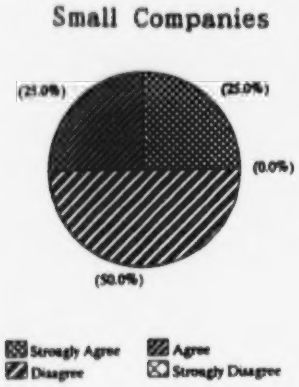
In addition, some respondents felt it is a better strategy to hold the new discovery "close to the vest" and exploit as many early opportunities as possible before pursuing a patent. Two responses that incorporated this thought process included, "Much proprietary intellectual property is better protected as trade secrets." and "...but don't discount trade secrets and know-how. Publication pressures dictate patent protection."

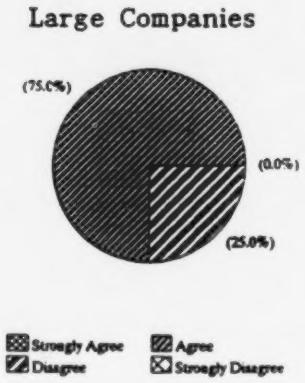
12. A new tech transfer office should be treated like any high risk start-up venture.



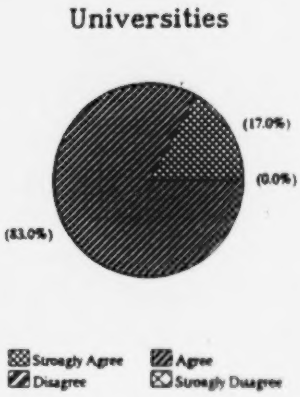


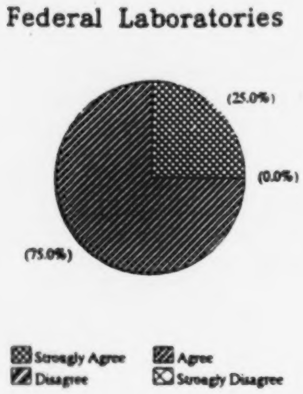


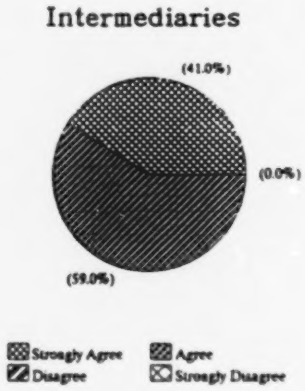


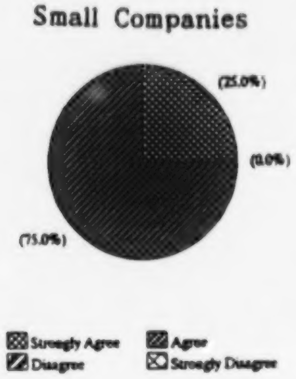


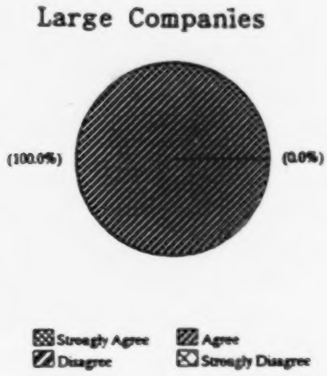
13. It should be viewed as a long-term investment with adequate capitalization and not be expected to produce short-term positive cash flow.











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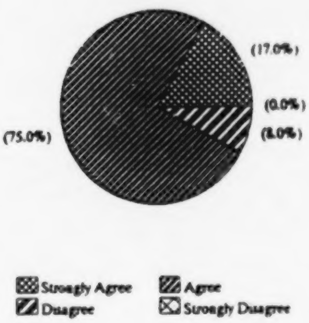
There are general feelings of agreement with statement 12, especially among public sector organizations. However, many respondents felt that particular operations of a tech transfer office were common to all tech transfer offices and therefore create minimal risk. One respondent noted, "Certain functions of the technology transfer are required (e.g. reporting, IP terms in research agreements, MTS's, etc.)" Another stated, "Individual projects may be high risk, but the outlook for the office as a whole should be better."

Although the vast majority of the respondents, once again, generally agreed with statement 13, it became clear that higher level administrators who allocate and are responsible for tech transfer office budgets are not totally "buying-in" to the view of the tech transfer being a long-term investment. A respondent noted the importance of early successes by the tech transfer office by stating, "However, aggressive strategies should be employed to create early example of successful transfers and cash flow for commercialization."

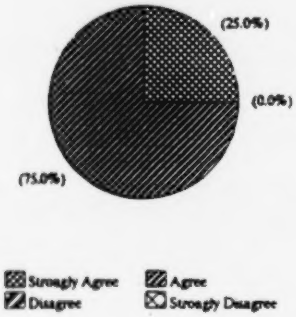
In some sectors, particularly the federal laboratories, cash flow is not a common criteria for tech transfer office evaluation. Two federal laboratories responded by stating, "Cash flow is not a criteria in Fed T2." and "Especially true in a federal lab, where cash income is not the objective."

14. Because of the lag time between the licensing of intellectual property and the receipt of royalties, universities must be prepared to provide an appropriate, consistent level of resources to offset the overhead cost of their tech transfer offices, which may not turn "profitable" for months or even years.

Universities



Federal Laboratories



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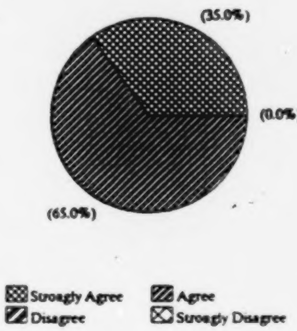
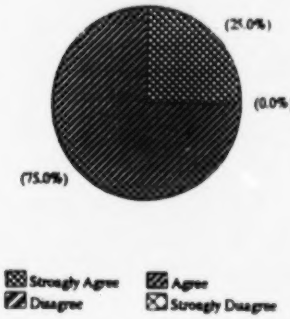
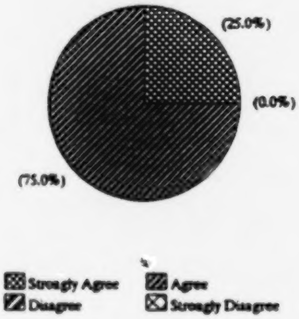


Small Companies



Large Companies



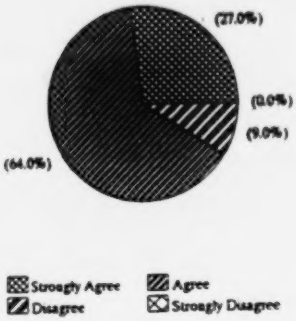
It should be viewed as nothing less than "striking" that 98% of the respondents agreed not only about the "consistent level of resources for a tech transfer office" but more importantly that these offices "may not turn profitable for months or even years." Supporting commentary included, "May never be profitable - shouldn't focus on income as the only measure of success." and "It's not 'may' and it's not months. Should read 'which predictably will not operate in the black for 5 - 8 years.'"

It is clear that much thinking needs to be done on appropriate measures of tech transfer success by university, industry and government segments.

15.Tech transfer managers, like managers everywhere, must make time for strategic longer term planning and avoid being consumed by short-term "fire fighting".

16. This is impossible if the institution does not commit a minimum threshold of resources.

Universities



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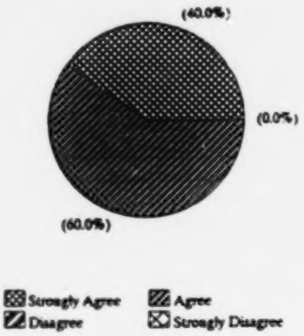

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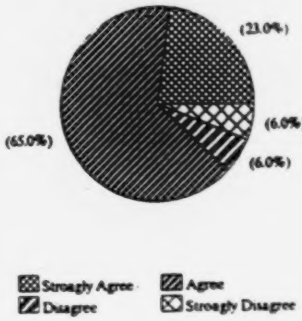

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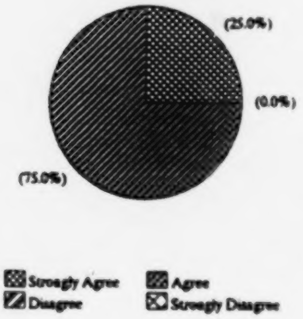

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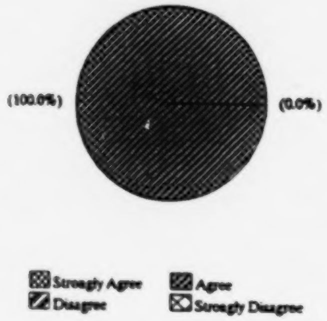
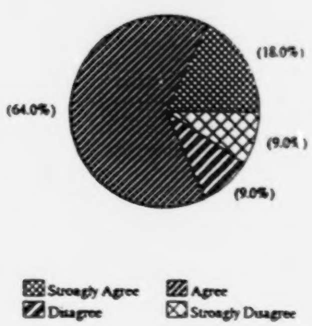
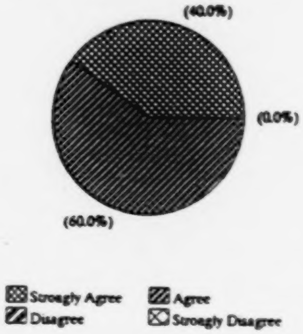


While there is strong general agreement with the statement, a minority view emerged which could be paraphrased: "Even in a severely resource constrained environment, a successful manager will allocate some time to strategic planning and accept the possible short-term negative impact on day-to-day operations." Commentary to support this statement included, "If you can't do strategic planning, then you are not doing your job. Find the time!"

17. Political leaders must be convinced that adequate public sector support of basic research is critical in providing the pool of ideas which subsequent joint public/private sector funding can convert into drivers of economic development.


Universities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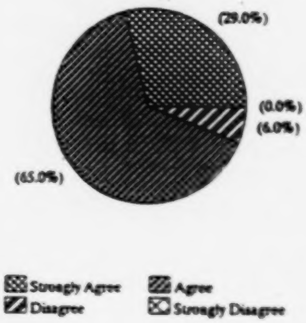
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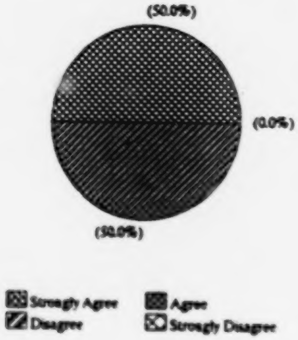
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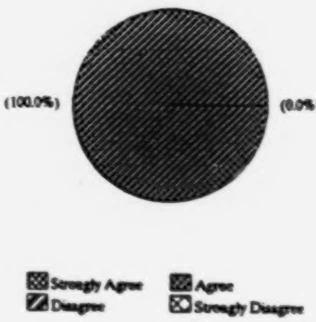
Large Companies

With two noted exceptions, all of the respondents agreed that political leaders must "be in the loop" for their potential to bring financial resources on a continuing basis into institutions of basic research. However, one university respondent noted that more than money was needed by stating, "The driver of economic development is trained students - a talent pool which is more critical than a technology pool - but both are necessary."

To be fair, a respondent who "strongly disagreed" took exception to the statement by responding, "Implies basic research is the source of technologies."

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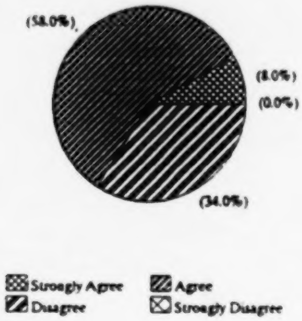
G: Public sector research institutions should reward their faculty/researchers by:

3. Allowing them to become shareholders in new companies formed to exploit their inventions.

Universities



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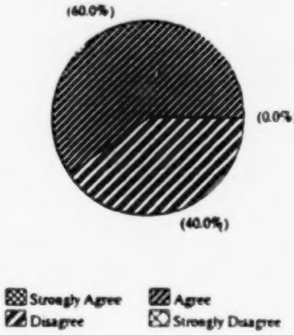

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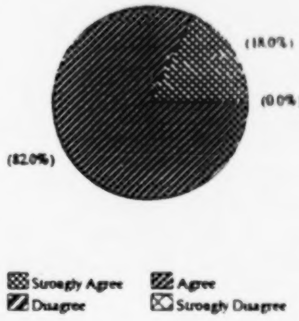
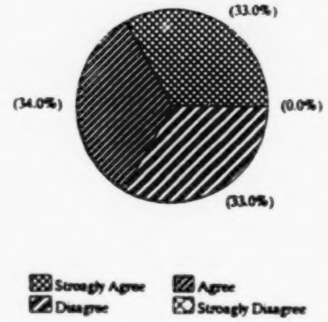
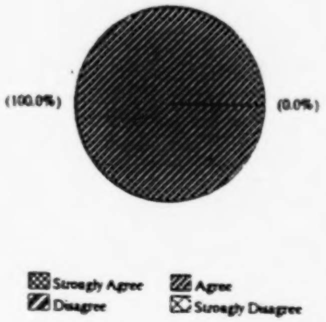


Small Companies



Large Companies

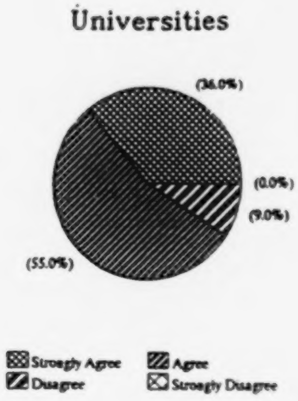


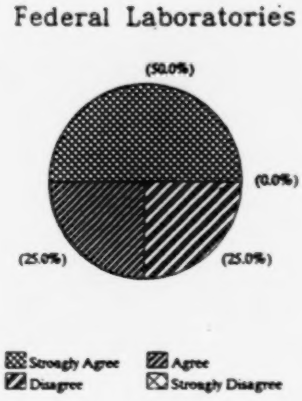
Many respondents did not note any difference between statement #2 where the authors suggested inventors "take an equity position in an existing company" vs. statement #3 where inventors "become shareholders in new companies."

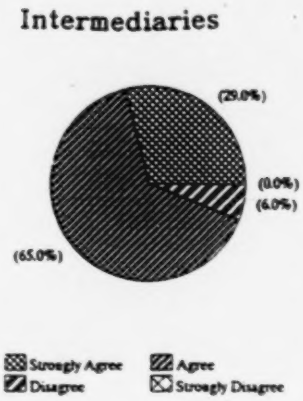
In any case, there was a large amount of feedback concerning potential conflict of interest. Representative commentary included, "Be careful of conflict of interest." "No - conflict of interest too great if technology is relevant to ongoing research programs." and "Clear conflict of interest."

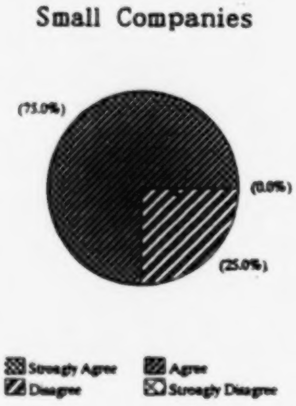
The conflict of interest issue was so hot among federal laboratories, that 100% of them made comments. Representative comments included, "I agree, but this is extremely difficult under federal conflict of interest regulations." And, "Conflict of interest risk too high unless they leave lab."

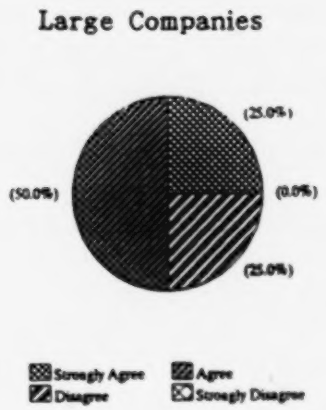
4. Academic researchers must be encouraged not to bypass the university and its tech transfer office.











The respondents feel that the university tech transfer office should operate in a "free market" more whereby academic researchers are drawn to utilize the resources of the office through superior service. One university respondent stated, "Some university T2 offices are so incompetent as to invite bypassing, especially if the faculty wish to support local development and the T2 office only knows how to license the established firms." And "Really it's the TT offices' task to constantly demonstrate its utility and user-friendliness."

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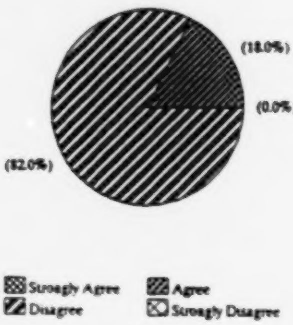
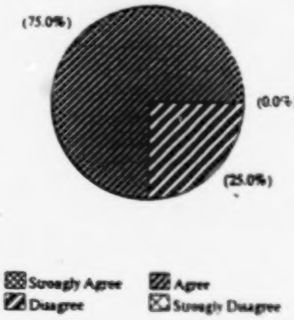
The reward and recognition system should be strong enough so that:

9. Faculty members are encouraged by university policies to spend a significant portion of their work-week on tech transfer activities.

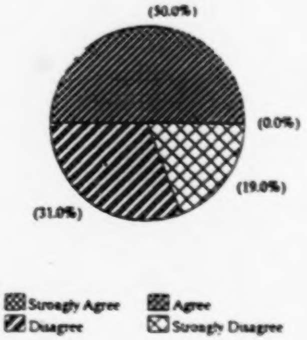
Universities



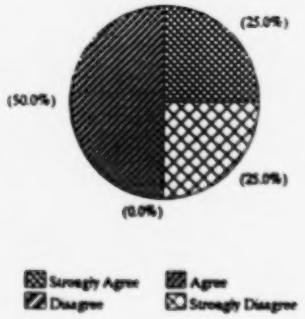
Federal Laboratories



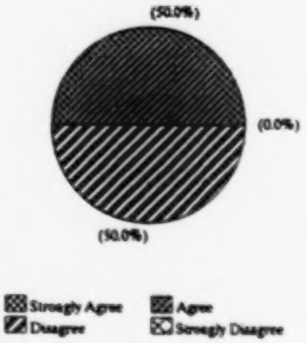
Intermediaries



Small Companies



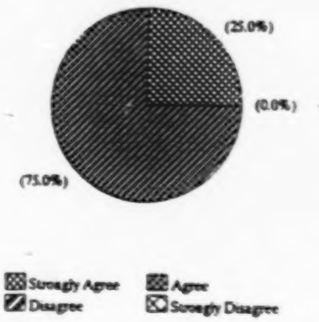
Large Companies

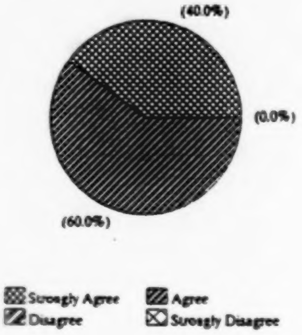


With this statement, the authors take responsibility for not being more specific (i.e. 20%, 35%, etc.) rather than using the phrase, "significant portion" in addressing the question of how much time faculty members should commit to T2 on a weekly basis.

Regardless, it is clear that universities are not in favor of developing policies that require faculty members to participate in T2 activities. One summary comment says it all: "It should be up to them." In addition, many respondents took this opportunity to state more broadly how universities regard T2 in general. Representative commentary included, "Tech transfer is not very important to many universities. They give 'lip service', however faculty are not rewarded beyond their research endeavors." And "Some faculty are not interested."

10. The tech transfer office should position itself to minimize potential conflict between the research and technology transfer mission of the university.


Universities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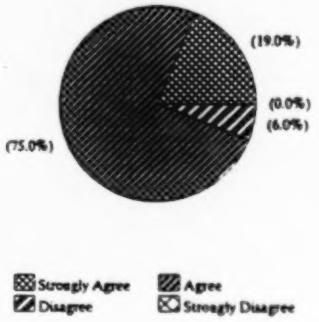
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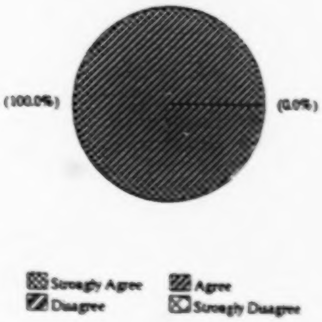
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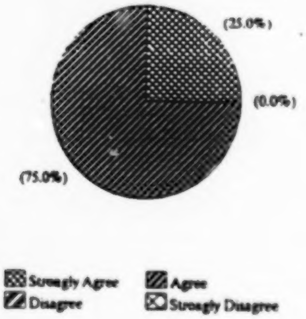
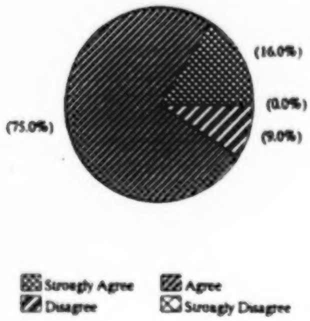

Large Companies

Although there is general agreement with this statement, there is a great deal of concern with the policies and procedures and the degree of support that will be provided by administrative personnel. One university respondent commented, "This is critical - inflexible tech transfer policies cannot drive the research enterprise! You simply can't turn down research funding because of terms for an invention which may or may not be developed somewhere in the future."

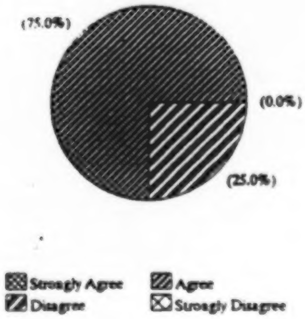
Many respondents felt that faculty members should find and utilize alternative means to acquire research dollars rather than to add this additional burden on the tech transfer office. A comment in this area was, "This doesn't seem like the proper role for the tech transfer office..."

Finally, it became clear that deans and other administrators will only promote the mission of the tech transfer office if it is a benefit to them or their department. Three representative comments were: "This will be more palatable if departments get a share of royalty income." "Tough to get some deans, etc. involved." And, "Lots of luck!"

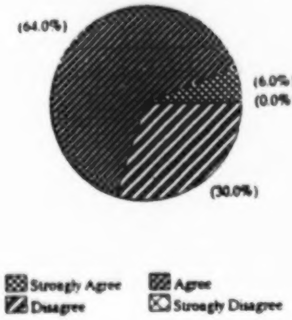
16. The greatest reward for public sector laboratories and their supporting staff is more often increased public visibility of the laboratory and its activities then it is institutional or personal monetary gain.



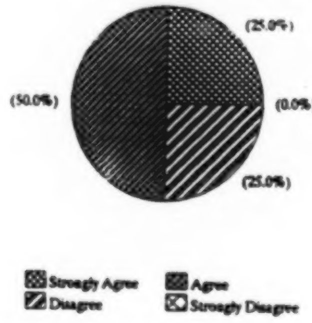
Universities



Federal Laboratories



Intermediaries



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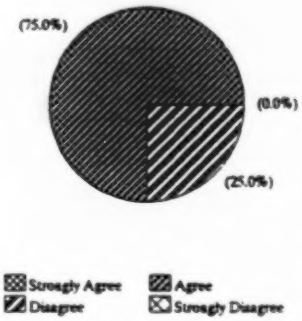

Large Companies

As public sector institutions, universities felt particularly strong agreement with a reward of increased public visibility vs. monetary gain. For both federal laboratories and universities, good "PR" is translated into continued/increased funding of its operations. This claim is substantiated by a comment from a university respondent who stated, "...and we should publicize the hell out of our successes."

There is clearly a different point of view from private sector organizations. Many private sector respondents felt that positive "PR" was one reward, but not one of greatest desirability. Typical commentary included, "It is a motivator" and this is "a major problem with T2 in their institutions."

V. FINAL CONCLUSIONS

In the course of our study and the analysis of the survey results it became clear that there is often a considerable difference between what "common wisdom" prescribes and what is being done by actual practitioners. Some of the areas where this appeared to be the case included:

Keeping it Simple

An important key to success in a technology transfer project is to "keep it simple" when it comes to organizing and managing the project. The technology transfer process itself is complicated enough without "designing-in" complicated organizational structures or communication channels. The respondents felt, for the most part, that applying current principles of leading-edge management theory such as Total Quality Management (TQM) is worthwhile. However, this must be done selectively and purposefully and the process carefully monitored for effectiveness and benefits, avoiding a "flavor of the week" approach. The important thing is to maintain project focus with a constant eye toward the goals of complete and successful transfer.

Technical Audits

When we proposed that R&D departments go through a technical audit to weed-out non-productive R&D, we struck a raw nerve with many of our respondents. Auditing appears to be one of those issues that will always leave someone or some group unhappy. Audits seem to be handled with a "fact-of-life" attitude within the private sector, but are viewed as more of a subjective, personal affront by a large percentage of those in the university sector. Since many universities seem averse to the concept of a technical audit, it is tempting to speculate as to whether or not such universities are really achieving the maximum bang-for-the-buck from the research dollars contributed to them. Or have we simply run up against the ramparts of academic freedom? In contrast, it was refreshing to find that 80% of the federal laboratory respondents looked favorably upon the technical audit.

The Role of Intermediaries

There is no doubt that most technology transfer intermediaries are qualified, dedicated individuals/organizations that offer valuable services to those involved in technology transfer projects. But in too many instances, their role in a given project has a low priority in the minds of the other participants. Broadly, small businesses tend to view intermediaries as too expensive and their range of services as too narrow. Large companies, on the other hand, often do not see the need for intermediaries because they feel they either have all of the intermediary's expertise in-house or will buy it and bring it in-house. Federal laboratories appear to have a limited patience with intermediaries, often viewing them as intrusive or a nuisance.

Over the long term, intermediaries that are ill-qualified or offer poor services will lose credibility while those with only the best tools and services will survive. But because the time constaints in the technology transfer process are long (years) this shake out will take time, during which the credibility of the intermediary process will remain in doubt.

Support for Technology Transfer

Although this is a period of shrinking R&D budgets in many companies, especially the larger ones, it appears that technology transfer activities are more likely to be adequately funded and supported within the private sector than in the public sector. Perhaps this is the case because private sector companies realize more and more that much of the technology they need to remain competitive is likely to be found, at least in part, outside their own laboratories. Thus the best companies are vigorously pursuing technology transfer from a "pull" perspective. In the public sector, on the contrary, particularly in universities, technology transfer is carried on in a "push" mode, often with a goal of making money to help offset shrinking revenues from other sources. Many of the technology transfer offices set up under these circumstances are under-funded and ill-equipped to carry out a broad-based, effective technology transfer mission. Potential licensees from the private sector, seeking the technology they need to stay in the business or start a new business, are often discouraged as they attempt to deal with such offices. Before establishing a technology transfer office, a university should first determine that it has the ability to generate a flow of potentially licensable technology and then prepare a business plan with a break-even point five to ten years out. If it cannot generate the technology and afford the investment then it should not establish the office to begin with.

For a university technology transfer office to be successful it must possess a certain degree of aggressiveness towards its mission. In addition, it must have the whole-hearted backing of the campus administration to help it clear the inevitable hurdles that will be put in place by entrenched interests on campus who will feel threatened by the existence of the technology transfer office.

Many universities that have gone to the expense of opening technology transfer offices have done so for the wrong reasons (i.e. instant wealth). To compound the problem, many of these offices are starving for resources and lack a highly publicized mandate from the top tier of university administrators other than a general directive to "generate revenue!" To further compound the problem, in too many cases the university's best researchers and technologies are found to be inaccessible, in the name of "academic freedom."

If the major university systems in the U.S. really want to foster competent technology transfer operations, they must, as one respondent put it, "do more than lip service."